MASSACRE OF AN ENGINEERING PARTY.

Jonathan Gustavsen, a civil engineer, who arrived in this city on Saturday last, from Topeka, Kan., gives a graphic recital of the massacre of a railroad engineering party on the plains of New Mexico by Apache Indians. His story is as follows: In May last the Atchison, Topeka and Santa Fe Railroad, having decided to extend the line from Santa Fe through the Indian Territory to Blue Spring, Kan., sent out a party to locate the course of the new line. This party, eighteen in number, was made up as follows: H. Burchill, engineer, in command of the party; C. B. Ball, transitman; Jonathan Gustavsen, leveler; C. Clare, rodman; Lawrence Hallen, topographer; Frederick Spaulding, head chainman; Robert Ling, hind chainman; W. Wendell, axeman; George Howells, axeman; Cheny Braly, stick man; John Seeley, stick man; Lawrence Miller, flagman; Jerry Connor, helper; Frederick Leslie, helper; Charles Woodern, helper; Frederick Evalt, helper; Charles Cameron, teamster; Charlie, a negro cook. The three engineers commanding the party had all been in the employ of the Northern Pacific Railroad, west of the Rocky Mountains, for four years past, and had left their positions on that road to go out with the party.

During the first three months all went smoothly, and the work upon which they were engaged proceeded rapidly and satisfactorily. As the middle of August approached the party found itself on the plains of New Mexico, between the Snake River and the North Fork River, and about thirty-five miles from the town of St. Elmo. A band of Crow Indians and a small body of Cheyenne Indians were also in the vicinity, and evinced a very friendly disposition toward the whites. From these Indians it was learned that a band of hostile Apache Indians were believed to be lurking in the neighborhood. About eleven o'clock on the morning of August 12, as the party was at work not far from the Snake River, fixing the course of the railroad line, two shots were suddenly heard. A moment later Mr. Burchill was seen running from the direction of a low clump of hills near which he had been at work. He ran up to where Gustavsen was standing with several of the men and cried: "I have just been shot at. I think the Apaches are around us. If so, we may leave our souls to God."

As he spoke a number of Apache Indians, in full war paint, appeared on the clump of hills in the direction from which Mr. Burchill had come. Gustavsen gave a warning signal assembling the men around him. He had been a cowboy in his day, and this was by no means the first fight in which he had been engaged with hostile Indians. He hastily counseled the men to keep well together, without crowding each other, and to retreat as rapidly as possible toward the camp. He wound up his injunctions by exclaiming:

"Let us keep cool, anyway, and if we have to part with our skins let us sell them as dearly as we can."

The men responded cheerily to this sentiment. In the meantime the Indians, having come nearer, opened fire. The whites fired back and began the retreat toward camp, over three miles away. There were about fifty Indians in the attacking party. A running fight followed. The Indians galloped warily around the whites, who were on foot, and the latter as they fled turned at intervals and fired at their pursuers. They obeyed Gustavsen's directions and avoided getting separated. The character of the country, which abounded in little knolls, was favorable to escape. After chasing the whites about a mile toward the camp, the Indians gave up the pursuit. When camp was reached it was found that two men—Lawrence Hallen, the topographer, and Frederick Leslie, a helper—were missing. They had been working close to the hills from which the Indians emerged, and it was supposed that they had been either killed at the first fire or captured. They have never been heard from since. None of the other members of the party had suffered any serious mishap. Both the missing men were about twenty-five years old, unmarried and had been engaged in Omaha.

After this encounter with the Apaches, the closest watch was maintained, and pickets were placed on watch day and night. About midnight on August 16 the party was encamped near the Snake River. A couple of miles away was the camp of the Crows. All the members of the party were asleep, with the exception of the pickets and C. B. Ball, the transit engineer, and Charles Clare, the rodman, both of whom sat beside the camp-fire, talking. Suddenly a fusillade rang out in the stillness of the night, and both the men sitting beside the camp-fire fell forward, dead. In an instant Gustavsen awoke and realized that the Apaches were upon them. At that moment Engineer Burchill cried out,

"We are attacked! For God's sake, boys, keep together."

The men had previously been instructed, in the event of a night attack, to lie on their stomachs and fire in that position. In this position they could less readily be seen by the Indians and offer less of a target for the enemy's fire than in any other position they could have assumed. In spite of the suddenness of the attack and the rude manner in which they had been awakened from their sleep the men kept their heads well and followed the instructions which had been given them. The moon was shining, and in its light a number of dark forms could be discerned crawling over the ground in the direction of the camp. The whites fired upon these dark figures, and the Apaches returned the fire. The fusillade kept up by the Indians—who seemed about fifty in number—showed the whites that they were being attacked from the front and on each side. At the same time they felt convinced, although there was no firing from that direction, that there were Apaches hovering about their rear to guard against their escape. Thus the fight continued, the fire of whites and Apaches alike being guided by the flash of a rifle or the glimpse caught of a dark shadow flitting across the moonlit prairie.

But soon a more brilliant light than the moonshine was thrown on the scene. Suddenly a cracking sound was heard, two bright flashes of flame shot up in the air, and, to their dismay, the whites perceived that their camp was on fire in two places. In the excitement of the battle an Apache had succeeded in stealing up to the tents unperceived and had set them on fire. The tents burned so fiercely that they were completely destroyed in ten minutes. Up to this time the advantage of position had been somewhat in favor of the whites, as they lay in the shadow of the tents, and only the flash of their rifles served as an object at which the Indians could aim. The Apaches, on the other hand, were frequently caught sight of in the moonlight, and thus made the object of a fatal aim. The bright light of the burning tents, however, turned the scale in this respect in favor of the Apaches, and the whites suffered severely. The encircling fire of the Indians grew closer and closer to the whites, who maintained a desperate resistance, and who shot with such accuracy and telling effect that the Apache approach was made with slowness and deliberation.

Of the burned tents nothing but the fitful embers remained and the fight had lasted upward of an hour, yet the whites still resisted and fired with deadly aim. But the Apaches were drawing momentarily nearer and nearer around the site of the camp, and one by one the guns of the whites were silenced. At last Gustavsen saw Apaches on each side of him, less than thirty yards off. Bullets were whistling all about him, every instant he expected to receive his death wound. He had fully given himself up for lost, when all of a sudden the Crow war cry broke out from behind the Apaches. The friendly Crows had been attracted by the firing and had come to the rescue of the whites. They outnumbered the Apaches, and the latter were compelled to hastily withdraw, fighting fiercely as they went.

When the Apaches had been driven off, and the camp of the whites was searched, it was found that only three of the party had survived the Apache attack. C. B. Ball had been shot in the head, and had fallen forward with his head in the fire, beside which he had been sitting. Clare, the rodman, had been shot in one temple, the bullet coming out by the other. His hands and arms were burned by his having fallen into the camp-fire. Frederick Spaulding, the head chainman, a lad of eighteen years, with beautiful blonde hair, lay with half his scalp torn off. An Apache had evidently been in the act of scalping him when he was frightened off by the approach of the Crows. In his haste the Apache had broken his knife, and a portion of the blade was embedded in the dead lad's skull. The thirteen dead whites lay where they had been shot—beside their guns. The three survivors were Jonathan Gustavsen, Cameron, the teamster, and Charlie, the negro cook. They were taken to the Crow camp, where they were carefully attended to. On the following morning the dead whites were buried in one deep grave dug near the spot where they had fought so fiercely for their lives. All the instruments and papers of the party were lost in the burned tents. The Crows assisted the three survivors to St. Elmo, whence they were transported to Topeka.

MEASUREMENTS OF THE DEPTH OF SLEEP.

Some interesting experiments relative to the depth of sleep were recently made by two German scientists, who worked upon the principle that the depth of sleep is proportioned to the strength of the sensory stimulus necessary to awaken the sleeper—that is, to call forth some decisive sign of awakened consciousness. As a sensory stimulus they made use of the auditory sensation produced by dropping a lead ball from a given hight. The strength of the stimulus was reckoned as increasing, not directly as the height, but as the 0.59 power of the height. For a perfectly healthy man, the curve that they give shows that for the first hour the slumber is very light; after 1 hour and 15 minutes the depth of sleep increases rapidly, and reaches its maximum point at 1 hour and 45 minutes; the curve then falls quickly to about 2 hours 15 minutes, and afterward more gradually. At about 4 hours 30 minutes there is a second small rise, which reaches its maximum at 5 hours 30 minutes, after which the curve again gradually approaches the base line until the time of awakening. Experiments made upon persons not perfectly healthy, or after having made some exertion, give curves of a different form.

THE BOUNDARY LINE.

ARRIVAL OF LIEUTENANT SYMONDS AND PARTY AT SAN DIEGO.

First Lieutenant Thomas W. Symonds, United States engineers and party, who left Deming, N. M., July 12, to make a reconnoissance along the boundary line between the United States and Mexico, from Paso del Norte to the initial point on the Pacific Ocean, near San Diego, arrived in this city about one o'clock yesterday afternoon, having completed their work.

A treaty was ratified by the two governments in March last, which provides for a resurvey of the line for the purpose of establishing monuments at distances not more than five miles apart, and in places where the population is dense, at such lesser distances apart as may be recommended in the report of the officer charged with this preliminary survey. The War Department detailed Lieutenant Symonds for this service, with instructions to report upon the condition of existing monuments, the number of new ones required, etc., character of the country along the line, facilities for wood, water, etc., and all necessary information for the conduct of the regular work under the treaty, which will be commenced next year, and occupy about two years.

The treaty provides for a similar survey on the part of the Mexican Government. Lieutenant Symonds, on arriving at El Paso early in July, waited upon General Revueltas of the Engineer Corps of the Mexican War Department, to make arrangements. General Revueltas agreed to detail some officers to co-operate, but, although Lieutenant Symonds' party entered Mexico at two points where he had reason to expect to meet the Mexican detachment, no information could be obtained of it, nor has anything been heard of the Mexican party along the whole line.

Lieutenant Symonds organized his party at Deming and started on the expedition July 12, since which date the entire distance of 1,200 miles to San Diego has been traversed, with rests of eleven days at Fort Hauchuca and nine days at Yuma. The party was composed as follows: First Lieutenant T. W. Symonds, commanding; Second Lieutenant Alliare, Twenty-third Infantry, commanding infantry escort; Frank Bartlett, Chief of Scouts, Department of New Mexico; Cornelius Mahoney, Secretary of Expedition; twenty non-commissioned officers and men of the Fourth Cavalry; two packers; four teamsters and two Mescalero Apache scouts. At Cloverdale, near the entrance of Guadalupe Cañon, the infantry escort and wagons were sent back, and at Fort Huachuca the two Mescalero Indian scouts were sent to San Carlos for more pack animals, which were brought by three new Indian scouts. The party then consisted of thirty-two persons, and thus entered San Diego yesterday.

The expedition reached Cloverdale July 22 and entered the famous Guadalupe Cañon on the 24th. This cañon is eighteen miles long and leads into Old Mexico. It was through this avenue that Crook passed on his late campaign. The entrance to the cañon is horribly broken. The men had extreme difficulty in crawling along for the first two miles, and it was with great effort that the horses and pack animals were led in. About six miles in was found the monument erected by Emory thirty-three years ago, in a good state of preservation. The course of the cañon is extremely tortuous. From its outlet on the Mexican side to the San Bernardino Ranch, where the party halted, it is about twenty miles over a rolling mesa. The forty miles from Cloverdale, through the cañon to San Bernardino, was made in one day.

July 28 the expedition reached Fort Huachuca and rested while the Mescaleros were sent to San Carlos for additional pack animals, which were brought in by three Indians from the reservation, who remained with the party. They left Huachuca Aug. 9, reaching the town of Nogales, where the Sonora Railroad crosses the line between Arizona and Sonora, on the 12th.

August 16th the expedition entered Mexico, passing through the mining camps of Planchas de Plata and Promontorio, and on the 18th began to enter the desolate Senora Desert country. From a point called Sasabe to Yuma, 230 miles, water ceases to be permanent, there being but one small spring at Quitobaquita (140 miles from Yuma), and that liable to be dry. This is considered the most perilous journey. Lieutenant Symonds evinced

careful forethought in preparing for it. The expedition was so timed as to reach this region in the season of the Sonora rains, when the water holes might be expected to be filled up, and arrangements were made for packing water on the animals. The numerous graves all along the route attest the fearfully desolate nature of the country; in one place forty were counted and in another a group of seven. The journey was made wholly by night marches, the fearful heat of the sun making day travel impossible.

The expedition reached Yuma, all well, August 30th, tarrying nine days for rest and renewal of outfit.

Leaving Yuma September 8th, the march across the country to San Diego was accomplished in ten days, the initial monument at Tia Juna being reached yesterday morning, and the Quartermaster's corral at the barracks in this city at one o'clock yesterday afternoon.

The trip from Yuma was comparatively easy. Water was packed over the dry stretches, and when the desert was passed there was no trouble. During the entire trip of 1,200 miles, not a man was sick, and no casualty of any kind occurred. The only loss was that of a single horse on the Sonora Desert.

Lieutenant Symonds is certainly to be congratulated upon having brought his expedition through with such remarkable success. He has had large experience in field work, having been associated with Lieutenant Wheeler in the Government surveys in Nevada and Oregon. He has recently been in charge of the works for the improvement of the navigation of the Mississippi, and was called from that service to undertake this reconnoissance. He will remain in San Diego during the week, and go hence to Washington. The men composing the expedition will return to New Mexico by rail.

Mr. Mahoney, secretary of the expedition, has had some years' experience as a frontier correspondent, and is well-known in newspaper circles in New Yark and San Francisco. He is the correspondent of the New York *Herald* with this party, as he was with General Crook's expedition in the spring against the Apaches. We are under obligations to him for information regarding the reconnoissance just finished.—*San Diego Union.*

WORK ON THE PARALLELS.

The New York and Connecticut Air Line Railroad is apparently doing all it can toward building its road. As the Parallel it has been before the public for near a dozen years, but since a change of name it seems to have acquired new energy. Still there is everywhere a feeling of doubt if this enterprise really means business, and not until the road actually pays for its right of way and expends the $50,000 required by the law will this doubt be removed. The promoters of this line are certainly spending considerable money.

A large amount of work has been done in the office of H. G. Scofield, city surveyor of Bridgeport. Elaborate maps in profile and layout have been there completed within the last few days, requiring several draughtsmen to work out the labors of the surveying parties. A surveying party to the number of six are at work on the road between there and New Haven for the purpose of completing the details of the survey to be used in preparing town maps which, according to the law, must be filed in the town clerk's office of the town through which the road passes within 90 days after the acceptance of the layout by the commissioners. Starting from New Haven, this surveying party has reached a few miles west of Milford and is progressing along at the rate of about a mile and a half a day. The party in charge has orders to proceed as far as Norwalk. An agent of the road has bonded the layout through the town of Stratford and will continue the work as rapidly as the weather will permit. He so far has found no difficulty in his work, owners of the land being willing to accept a fair valuation and there is no probability that appraisers by the court will be called out to settle disputes. We doubt if it is as much a sign of good feeling toward this enterprise as it is an opportunity for landowners to unload to a small extent, and so they grasp at even the prices offered by the road. The money to pay expenses comes from Stamford probably, through the agency of Lawyer Olmstead, although the engineering work is mainly in charge of a party from Providence, R. I.

Following closely upon the heels of the surveys now out is the corps in the interest of the Hartford & Harlem, who to the number of nine make the Sterling hotel at Bridgeport their headquarters. They are very reticent in regard to their movements, declining to give, by orders of those in interest, any information. This refusal was made wholly on the plea of business, and as the gentleman in charge seemed to regret his inability to offer the public the necessary information, we can only report the apparent work. In West Haven the line of the former mentioned road was crossed by surveyors of this latter line, taking their lines to the south, and closely following the N. Y. & C. A. L. R. R. layout. In fact, the lines for several miles are parallel, and only a few feet apart. If both roads were to be built, their embankments would touch. At first these surveyors were some miles ahead, but are now some distance behind the first-mentioned party. They don't seem to be much in a hurry, probably having in mind the decision of the commission that the old line has the first chance to do what—to do nothing.

Whether it is nothing or something, real estate in the northern part of this city is advancing in value, and there is a larger demand than there has been for years. Better prices can be obtained, especially in the neighborhood of the proposed lines of these railroads, which as far as it goes would indicate that the public have a little hope that a road may yet be built.—*New Haven Paper.*

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page* 476.)

DLXIX.—INDUSTRIAL SCHOOL FOR GIRLS, CONN.

The Connecticut State Industrial School for Girls is situated near Middletown, Connecticut, and was established in 1870. Water-works were built in 1882 after plans of E. P. Augur, C. E., taking the supply by gravity from the drainage of a watershed of 0.8 square mile. A dam 300 feet long, of earth, with puddle wall in the centre, impounds the water, which is conveyed to the institution and distributed by 1½ miles of wrought iron and clear cement pipe as made by D. Goffe Phipps, 6 inches in diameter. There are two fire hydrants and 7 gates. No statistics of cost or consumption are furnished.

DLXX.—SALINA, KAN.

Salina, Kansas, in lat. 39° N., long. 98° W., is on Smoky Hill River on level ground.

Water-works were built in 1883 by a private company taking the supply from a well sunk in gravel to a depth of 38 feet, and pumping by a Holly steam pump directly into the mains, with 25 pounds ordinary pressure. Connection is made with the river for fire service. Distribution is by 4 miles of cast-iron pipe of 12 to 6 inches in diameter with 40 fire hydrants and 50 taps. The city pays $100 per year for each hydrant. The population in 1880 was 3,111. The capital stock of the company is $100,000. The cost of the works, which have recently gone into operation, is not given. J. E. Bonebrake is president and E. H. Gibbs secretary.

DLXXI.—EVART, MICH.

Evart, Michigan, in lat. 43° N., long. 85° 30′ W., in the heart of a great lumber region, was settled in 1874.

Water-works were built by the village in 1880, taking the supply from a well and pumping directly into the mains by a Dixon pump of 14-inch steam and 8-inch water cylinder of 16-inch stroke, and a Perkins pump of 14-inch steam and 8-inch water cylinder of 12-inch stroke. Distribution is by one mile of Wyckoff wooden pipe of from 4-inch to 1⅝-inch diameter, with ten fire-hydrants. The number of taps and the cost of the works can not be obtained. The bonded debt is $5,190. The population in 1880 was 1302. The receipts in 1881 were $936.05 and the expenses $1,934.53. The works are managed by three Commissioners. Jessie T. Minchin is secretary.

THE NEW TIME STANDARDS.

BOSTON, Oct. 9.—The proposed new standards of time for the railways of the country, which are to be established by the General Time Convention of Railroad Managers, which begins in Chicago tomorrow, has received the approval of the Harvard Observatory, and its co-operation is promised, The railroads centering here acquiesced in the plan on the condition that the time given from the observatory should be correspondingly changed. The consent of Prof. E. C. Pickering, the Director of the observatory, being necessary, he was met in New York promptly on his arrival from Europe on Sunday by Mr. J. Rayner Edmonds, of the observatory, and his hearty approval of the scheme was readily given. Accordingly, a note has been sent to the Secretary of the Chicago Convention, W. F. Allen, to this effect, and assurance given that if the convention adopts the system the observatory will be ready to furnish telegraphic signals conforming to the minute and second of the proposed standards.

Under the new system, instead of running the various systems and divisions of systems by as many local standards of time, the continent is to be divided into five broad belts, running north and south, the time for each of which will be one hour slower than that of the next division to the eastward and one hour faster than that of the next division to the westward. By this plan the minute hand of a traveler's watch will not have to be changed, however far he may have to travel or in what direction; but his watch will be just one hour slow when he crosses the imaginary line into the next division to the east, or an hour fast when he crosses the line into the next division to the west. The time now furnished by the Harvard Observatory is the mean solar time for the Boston State House. The new time will be 15 minutes 44.5 seconds—practically 15¾ minutes—slower and will be the average time for this division, which includes the New England States, New York and Pennsylvania and the greater part of Canada. North of Lake Erie the division extends west to Detroit, while south of Lake Erie Pittsburgh is practically on the western boundary of this division. Thus in the region north of the lake the standard time will be five hours slow by Greenwich and south of Lake Erie and west of Pittsburgh it will be six hours slow by Greenwich. The new standard, if adopted, will go into effect on a Sunday noon, and from that hour all the railroads will be run by the new time.

The new time standard was adopted Oct. 11 by 78,000 miles of railway.

THE ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.

The Engineers' Society of Western Pennsylvania held a regular monthly meeting on Tuesday night, Sept. 18, at Pittsburgh, this being the first meeting since the usual summer vacation. The paper of the evening was read by Mr. S. B. Fisher, of the Pennsylvania Railroad, in which he argued for better highways, especially those which radiate from railroad stations.

Mr. Fisher thought that local roads radiating from railroad stations should be paved so that steam motors could traverse them. Factories could thus be built at any place on the line of a turnpike with connections with one or more railways at the most accessible stations. An almost unbounded field would then be opened for small manufacturing interests. The great obstacle to highway improvements is its cost. The National highway from Cumberland to Wheeling, which is 130 miles long, cost $1,700,000, or $13,000 per mile.

The stone would be the largest item. A roadway twenty-four feet wide and eighteen inches deep would require 7,000 cubic yards of stone per mile, which might be obtained in a country where it abounds for say $7,000, and the whole cost would be about $10,000 per mile. If the adjoining land was assessed to make such improvement, say for a mile on each side, or 1280 acres at $8 per acre, the assessment would be $10,240. The reading of the paper was followed with an informal discussion.

THE CANADA ATLANTIC RAILWAY.

A correspondent of the Boston *Journal* writes: The Canada Atlantic Railway is in operation from Coteau, on the St. Lawrence River, to Ottawa, a distance of 78 4-10 miles. The Grand Trunk Railway connects at Coteau with the Canada Atlantic Railway, a distance of 37 miles from Montreal. The Canada Atlantic is operated by its stockholders, and the general manager is Hon. D. C. Linsley, of Burlington, Vt. The distance from Montreal to Ottawa via the Grand Trunk and Canada Atlantic railways is 116 miles. The Grand Trunk furnishes the engine and cars for the fast train which is run through between Montreal and Ottawa on a pro rata basis in 2 hours and 29 minutes; the rate of speed on the Grand Trunk being 41 miles per hour, and on the Canada Atlantic 50 miles per hour.

The Canada Atlantic was built under contract by Hon. D. C. Linsley, of Burlington, Vt., the chief engineer being Walter Shanly, Esq. Mr. Linsley is President of the Burlington & Lamoille Railroad, and has been a railroad contractor for thirty years. His experience on the Rutland & Burlington, Illinois Central, Vermont & Canada, and other roads as civil engineer and contractor has accrued to the advantage of the Canada Atlantic. The road is built on the latest scientific principles, so far as as the grading, alignment and curvatures are concerned. The curves are built much longer than usual, and the turns are gradual and present a graceful outline.* Manager Linsley has given much time and attention toward making a perfect track, and no readjustment of the track is permitted without conforming to the exactness of a spirit level.

The Canada Atlantic Railway is the result of Yankee sagacity and enterprise to a very large extent. The funds necessary to build the road were mainly secured by and contributed to by Vermonters. Among those whose efforts and money have done much toward pushing the Canada Atlantic Railway to its present stage of completion are ex-Gov. Gregory Smith, president of

*These curves were all laid out according to "Tables and Compound Curves," prepared by A. Torry, C. E., who was a protégé of Mr. Linsley, himself an able and enthusiastic engineer, who has in the above road carried into actual practice some of his theories as to proper railway building.

the Central Vermont Railroad; Messrs. Booth and Perley, leading lumber manufacturers of Ottawa, and Hon. D. A. McDonald and D. C. Linsley. The road was completed to the St. Lawrence River from Ottawa in the summer of 1882, and the work of building the section from Coteau to Alburgh Springs, Vt., where connection is made with the Central Vermont, is already well advanced. Much of the grading is done, and 7 miles of the road has been laid with steel rails. When completed the road will be 132 miles in length, and will shorten the distance by rail between Ottawa and Boston nearly 40 miles. The primary object of building the Canada Atlantic Railway was to secure a short cut for the immense lumber business of the Ottawa Valley to New England points. The route is direct and the grades are gradual and easy, the highest grade east being only 30 ft. to the mile.

DEPTH OF THE NIAGARA RAPIDS.

At a recent meeting of the newly-organized Society of Natural Sciences at Buffalo, N. Y., Prof. Pohlman read a paper on "The Depth of the Niagara River below the Falls." The professor remarked that it was out of the question to determine the depths practically at the usual stage of the water. Soundings marked on our maps could not be relied on implicitly. The U. S. Lake Survey gave the depth of the water 1,000 feet north of the new suspension bridge at 163 feet. The whirlpool had never been sounded.

Theoretically something could be done to throw a little light on the mooted question. One way in which it could be done was by a study of the geological formation of that section between the Falls and Lewiston.

So Dr. Pohlman concluded on geological grounds that the river between the falls and whirlpool could not exceed a maximum depth of 100 feet, and probably nowhere between seventy and eighty feet deep. The maximum depth was near the falls from where it shallowed toward the whirlpool rapids where the average depth could not exceed twenty feet. As to the depth of of the whirlpool, "we found," said Dr. Pohlman, "the bed of the preglacial Tonawanda outlet one mile north from its lowest fall to about fifty-five feet below the edge of the gray sandstone band, and within this mile of the whirlpool of the present day is situated. To these fifty-five feet we add the twenty feet of water which covers the gray band in the rapids and we have a maximum depth of this far-famed spot of seventy-five feet."

To corroborate this Dr. Polhman took the estimate that 20,000,000 cubic feet of water went over the falls every minute, and assumed the low estimate of a current of eight miles an hour between the falls and the whirlpool rapids. A current of one mile per hour travels eighty-eight feet in a minute past a given point. An eight-mile current travels 704 feet per minute; 20,000,000 cubic feet traveling at a rate of 704 feet per minute past a certain point will give about 29,000 square feet for the cross section of the river. The width of the river at the water's edge averages 900 feet between the falls and the beginning of the whirlpool rapids. This divided into the area of 29,000 square feet brings about thirty-two feet for the depth. This supposes the area of the cross-section to resemble a rectangle with sides of thirty-two and 900 feet. To make it more like the possible river bottom and give even a maximum depth we transform our rectangle into a triangle. Then we have a maximum depth of Niagara River between the falls and whirlpool rapids of sixty-four feet. Allowing for the retardation of the current on the sides and bottom would increase the depth within geological deductions. A ten-mile current under the circumstances would need a depth of fifty-six feet, a twelve-mile current forty-two feet, a fifteen-mile current about thirty-two feet.

PHILADELPHIA WATER-WORKS CONTRACTS.

At a special meeting of Councils' committee on water-works at Thirteenth and Spring Garden streets, on Tuesday, the proposals for cast-iron water-pipes, special castings and pig-lead were opened and scheduled. The first and second specifications call for 1,500,000 pounds of thirty-six-inch pipe and 325,000 pounds of forty-eight-inch pipe. Bids were received from the Mellert Foundry and Machine Company, 1.41 cents per pound; R. D. Wood & Co., 1.364 cents per pound; Gloucester Iron Company, 1.370 cents per pound, and A. H. McNeal, 1.375 cents per pound. The third item calls for 120,000 pounds of forty-eight and thirty-six-inch special pipe castings. The Mellert Foundry and Machine Company bid at 3¼ cents per pound; R. D. Wood & Co., 3½ cents per pound; Gloucester Iron Company, 3 7/16 cents per pound; A. H. McNeal, 3 cents per pound. The fourth item is for five 48 × 48 breeches pipes, four 36 × 36 breeches pipes and three 48 × 36 breeches pipes. The following bids were received: Mellert Foundry and Machine Company, 6 cents per pound; R. D. Wood & Co., 5 5/16 cents per pound; Gloucester Iron Company, 5 7/16 cents per pound; A. H. McNeal, 6 5/16 cents per pound. All the above specified castings are to be delivered at the Spring Garden engine house wharf. For the fifth and six items, calling for 1,500,000 pounds of 16-inch pipe and 500,000 pounds of 12-inch pipe, bids were received from the Warren Foundry and Machine Company, 1.44 cents per pound; the Mellert Company, 1.54 cents per pound; R. D. Wood & Co., 1.426 cents per pound; Gloucester Iron Company, 1.53 cents per pound, and A. H. McNeal, 1.515 cents per pound. The seventh item, for 53,000 pounds of 16 and 12-inch special pipe castings, brought bids from the Warren Company at 2¾ cents per pound; the Mellert Company at 2¼ cents per pound; R. D. Wood & Co. at 3 7/16 cents per pound; the Gloucester Iron Company at 2¾ cents per pound, and A. H. McNeal at 2 5/16 cents per pound. These pipes and castings are to be delivered at or near Germantown, on the Germantown & Chestnut Hill Railroad. The eighth specification is for 800,000 pounds of six-inch pipe, to be delivered to any part of the city, as may be directed by the Chief Engineer. The Warren Company bid for work at 1.55 cents per pound; the Mellert Company at 1.70 cents; R. D. Wood & Co., at 1.573 cents, the Gloucester Company at 1.57, and A. H. McNeal at 1.60 cents. The ninth item calls for 100,000 pounds of American refined lead: 50,000 pounds to be delivered at the office of the Purveyor, Corinthian avenue and Poplar street, and 50,000 at the office of the Purveyor at Germantown. Edward F. Niven proposed to deliver the lead at Corinthian avenue for 4.36 cents. per pound, and at Germantown for 4.39 cents per pound. The N. G. Taylor Co. desired to perform the same contracts at 4.42 and 4.45 cents per pound respectively.

KANSAS CITY CIVIL ENGINEERS.

A meeting of the Civil Engineers' club was held at 509 Delaware street on last Saturday evening, and was attended by Messrs. John Donnelly, W. J. Neir, W. B. Knight, R. Hattleman, A. A. Holmes, C. H. Knickerbocker.

After the transaction of the usual preliminary business, the following new members were elected: Major O. B. Gunn and Messrs. Edward Butts and Wm. Vleit.

Mr. W. B. Knight, chairman of the committee on securing permanent quarters for the club, reported in favor of rooms in the new Brisbone building at Seventh and Delaware streets. The report was adopted, and a committee of three was appointed to secure rooms in this building, and provide for furnishing them.

An informal discussion of city improvements and engineering then occurred, after which the club adjourned to meet on the 20th inst. at the new quarters.

AN ELECTRIC RAILWAY.

The formal opening of the Portrush Electric Railway, which took place on the 29th ult., must be regarded as an event of considerable importance, not only in the history of Ireland, but in the progress of electrical industry. The railway from Portrush to the Giant's Causeway is remarkable as being the first long electric tramway in the world. It is over six miles long, and has cost £45,000, which has been raised by a company formed in the country. The line, after passing through the principal street of Portrush, follows the seaside road, a footpath 6 ft. broad being reserved for the railway. The gauge is only 3 ft. and the gradients are very steep—in places as one in thirty-five—and in parts of its course the curves are sharper than might have been desirable had the route which it takes been chosen by the engineers. The force to work it is generated by a waterfall in the River Bush, with an available head of 24 ft., the electric current being conveyed by an underground cable to the end of the tramway. The water power passing through turbine water-wheels, which utilize the whole force of the fall, is said to amount to ninety horse. It is obvious that for a light train of tram-cars there is enough and to spare. The practicability of such a line is now a settled matter. The only question is whether it is likely to pay as a commercial venture. Considering that the initial power costs nothing, and that coal in Ireland is dear, there are good hopes that a line certain to be freely used by the continuous stream of tourists always going between Portrush and Bushmills, on their way to the Giant's Causeway, will satisfy the expectations of its projectors.

Mr. Edison says that the idea of propelling vessels through the water by electricity is a dream. He says it is not impossible, but it is impracticable. There is no motive power, and can be none, which does not require for its production the expenditure of equivalent energy beforehand. Mr. Edison says the dynamo batteries necessary to propel the steamer Alaska across the ocean, at the rate which she is propelled by steam power, would weigh 63,348 tons.

METRIC RAILWAY CURVES.

Several inquiries have appeared from time to time in ENGINEERING NEWS for a metric table of railway curves. We to-day present one prepared by an engineer who, after practicing the American method of laying out curves in the United States, has been for two years occupied in railroad surveying with the metric system in Mexico.

The table is explained by the headings of the columns. Curves are designated (as in the first column) by the angle which, according to the American system, has to be turned off repeatedly at a point on the circumference and is subtended by successive equal chords. This angle is called by Trautwine and Shunk the "tangential" angle; by Henck and Searles, the "deflection" angle. In the first article of the appendix to his revised edition, Prof. Henck suggests the use of this angle for designating curves run by the metric system. An obvious advantage thus gained is that the angle to be measured in staking out a curve in a field is simply the angle named in speaking of the curve. The equal chords successively measured according to the metric system should be 20 meters in length, as was abundantly enforced by numerous writers who discussed the point in ENGINEERING NEWS a year and a half ago. As to the adaptability of that length to railroad engineering, it may be noticed that in the first example of staking out a curve given in Shunk's "Field Engineer," the length of chord is taken to be 20.12 m., which he calls 60 feet. The stakes, set at successive 20-meter intervals, are to be marked with the successive *even* numbers, 2, 4, 6, 8, etc., so as to constitute the dekameter the unit of stake numbering. Each stake is thus designated by its distance in dekameters from the zero point, and each kilometer stake is marked by an exact hundred. The angle by which the curve changes its direction per unit of length as thus marked is, therefore, one-half of its change of direction between the extremities of the 20-meter chord; that is, it is exactly the "20-meter chord" angle used to stake it out and to designate it; and the total change of direction made by any length of the curve is simply the product of this angle multiplied by the difference in the numbers of the stakes at its beginning and end, just as in the present practice in the United States.

For convenience in staking fractional parts of the 20-meter chain, the second column of the table is given, showing the number of minutes to be turned off with the transit per meter, being simply one-twentieth of the angle in the first column. Here a slight advantage over the 100-ft. chord is seen, because 60 bears a simpler relation to 20 than to 100.

The column of radii presents a simplicity superior to the 100-ft. system, in that the metric radius is just 10 times the co-secant of the angle in the first column, and can therefore be taken directly from a trigonometrical table by altering the decimal point, or in the case of the logarithm, the characteristic. The computation in the present United States practice is a little more complicated. The difference thereby produced in the figures may be seen by comparing the columns of 20-meter chord angle and radius with the columns of degree of curve and radius in the field-books commonly used in this country. The metric radii, instead of being figured exactly one-tenth of the expression in feet corresponding to the same angle, have slightly larger decimals. The discrepancy is so small however, that for the greater part of railroad work the old tables might be used with the metric system, by taking the old degrees for the 20-meter chord angles and dividing all the old radii by ten, that is, merely changing the decimal point one place. It is different with the figures for deflection distances and ordinates, which in the metric table are almost exactly four-tenths of what they are in the old tables for the same angle in first column.

The precise length of the curve, in contradistinction to that of the chords by which it is staked out, is seldom required. The last column in the table is inserted chiefly with a view to exhibiting

the percentage to be added to such a chord to get the length of arc it subtends. This percentage is clearly seen when we move the decimal point of the last column one place to the left; and it may be made useful in connection with such tables as are given at the end of Shunk's "Field Engineer" and of the revised edition of Henck's "Field Book." For example, those tables give, among other very useful data, the distance from the intersection point to either extremity of a one-degree curve whose total length varies between 0° and 90°. Mr. Shunk calls this the "apex distance;" Prof. Henck, the "tangent." For a curve 90° in length, Mr. Shunk's table gives 5730 ft.; Prof. Henck's, 5729.7 ft., the same, of course, as the radius. Either of these divided by 10 can be used in practice for the metric 1° curve, whose radius is 572.99. (It would be still better in using the metric system to have a new table calculated expressly for radius 572.958.) To get with very close approximation the corresponding dimension for any other curve we divide by the degree designating the curve. Hence, for a 90° length of a metric 10° curve we should get a tangent or apex distance of 57.30 m. In the case of so sharp a curve the question arises whether this is sufficiently accurate for our purpose, and the question is answered by reference to the last column in the metric table. After moving the decimal point as above directed, we find 1.0051 for the 10° curve, showing that our 57.30 is in error by one-half of one per cent. To get exactly the distance required, multiply 5730 by 1.005, and we get 57.59, just as given in the metric table for the radius of the 10° curve. The same percentage correction is applicable to the other tabulated data as well as to the tangent or apex distance.

In computations like that discussed in the preceding paragraph, the 20-meter chord has the advantage over that of 100 ft. that it is a shorter length, and consequently the arc it subtends in any circle differs by a smaller percentage from the chord. Hence, the tabulated data above mentioned can be applied without requiring correction to a larger range of metric curves than of the curves used in the American foot practice. For example, observe that in the curves of 86.14 and 90.65 meters radius the percentage is less than one-quarter of one per cent. Between the two lies the 20° curve, as given in the American tables, with a radius of 287.9 ft., in which the 100-ft. chord subtends an arc of 100.5 ft., showing a percentage of one-half of one per cent. Accordingly, if we start with 5730 ft., the tabulated tangent or apex distance above cited for 90° length of an American 1° curve, and take one-twentieth of it for the corresponding dimension of the circle of 287.9 ft. radius, we have 286.5 ft., and must add 1.4 ft. to get the correct value equal to radius. On the other hand, suppose we had started with 573 meters as the tangent or apex distance in the metric 1° curve, to get the corresponding dimension of the circle of 86.14 meters radius observe that that circle is designated by the 20 m. chord angle of $6\frac{3}{4}°$; three-twentieths of 573 m. is 85.95 m., and to get the correct value equal to radius we must add 0.19 m., which is less than half of 1.4 ft., and less than one-quarter of one per cent.

Engineers accustomed to thinking of curves by their American designations may find it convenient in making mental comparisons to bear in mind that if any curve has its 20-m. chord angle multiplied by 3, the product is very nearly the "degree" used to designate the curve in this country: for 100 ft. is very little more than 3 dekameters. For instance, the curve last spoken of, having a radius of 86.14 m. and designated by the angle of $6\frac{3}{4}°$, is almost the same as the American curve of 20°, or $3 \times 6\frac{3}{4}°$. The number 20 is given in the metric table in the column of minutes to be laid off per meter in staking out, as belonging to the curve of 86.14 m. radius; and all of the numbers in that column, instead of being read as minutes, might be regarded as the "degrees" designating American curves, in which case the corresponding figures of radii would be nearly the true values in meters of the radii of those American curves.

METRIC CURVE TABLE.

20 m. Chord Angle.	Minutes to be laid off per meter.	Radius in meters	Logarithm of radius.	Deflection. From tangent.	Deflection. From chord.	Middle. Ordinate at distance from end-chord. Of 10 m.	Quarter point. Ordinate at distance from end-chord. Of 5 m.	Length in meters of Arc of designated number of degrees.
0° 10′	0½′	3437.75	3.5362745	.058	.116	.015	.011	10.0000
20′	1′	1718.88	3.2352463	.116	.233	.029	.022	10.0001
30′	1½′	1145.93	3.0591581	.175	.349	.044	.033	10.0001
40′	2′	859.46	2.9342237	.233	.465	.058	.044	10.0002
50′	2½′	687.57	2.8373192	.291	.582	.073	.055	10.0004
1° 0′	3′	572.99	2.7581447	.349	.698	.087	.065	10.0005
10′	3½′	491.14	2.6912059	.407	.814	.102	.076	10.0007
20′	4′	429.76	2.6332231	.465	.931	.116	.087	10.0.09
30′	4½′	382.02	2.5820810	.524	1.047	.131	.098	10.0011
40′	5′	343.82	2.5363351	.582	1.163	.145	.109	10.0014
50′	5½′	312.58	2.4949553	.640	1.280	.160	.120	10.0017
2° 0′	6′	286.54	2.4571808	.698	1.396	.175	.131	10.0020
10′	6½′	264.51	2.4224340	.756	1.512	.189	.142	10.0024
20′	7′	245.62	2.3902659	.814	1.629	.204	.153	10.0028
30′	7½′	229.26	2.3603204	.873	1.745	.218	.164	10.0032
40′	8′	214.94	2.3323107	.931	1.861	.233	.175	10.0036
50′	8½′	202.30	2.3060020	.989	1.977	.247	.186	10.0041
3° 0′	9′	191.07	2.2811998	1.047	2.093	.262	.196	10.0046
10′	9½′	181.03	2.2577414	1.105	2.210	.276	.207	10.0051
20′	10′	171.98	2.2354889	1.163	2.326	.291	.218	10.0056
30′	10½′	163.80	2.2143247	1.222	2.442	.306	.229	10.0062
40′	11′	156.37	2.1941477	1.280	2.558	.320	.240	10.0068
50′	11½′	149.58	2.1748701	1.338	2.674	.335	.251	10.0075
4° 0′	12′	143.36	2.1564155	1.396	2.790	.349	.262	10.0081
10′	12½′	137.63	2.1387167	1.454	2.906	.364	.273	10.0088
20′	13′	132.35	2.1217146	1.512	3.022	.378	.284	10.0095
30′	13½′	127.45	2.1053567	1.570	3.138	.393	.295	10.0103
40′	14′	122.91	2.0895961	1.629	3.254	.407	.306	10.0111
50′	14½′	118.68	2.0743911	1.687	3.370	.422	.317	10.0119
5° 0′	15′	114.74	2.0597040	1.745	3.486	.437	.328	10.0127
20′	16′	107.58	2.0317513	1.861	3.718	.466	.349	10.0145
40′	17′	101.28	2.0055032	1.977	3.950	.495	.371	10.0163
6° 0′	18′	95.67	1.9807654	2.093	4.181	.524	.393	10.0183
20′	19′	90.65	1.9573751	2.210	4.413	.553	.415	10.0204
40′	20′	86.14	1.9351943	2.326	4.644	.582	.437	10.0226
7° 0′	21′	82.06	1.9141055	2.442	4.875	.612	.459	10.0249
20′	22′	78.34	1.8940076	2.558	5.106	.641	.481	10.0274
40′	23′	74.96	1.8748128	2.674	5.336	.670	.503	10.0299
8° 0′	24′	71.85	1.8564447	2.790	5.567	.699	.525	10.0326
20′	25′	69.00	1.8388361	2.906	5.797	.729	.547	10.0353
40′	26′	66.36	1.8219279	3.022	6.027	.758	.569	10.0382
9° 0′	27′	63.92	1.8056676	3.138	6.257	.787	.591	10 0412
20′	28′	61.66	1.7903083	3.254	6.487	.816	.613	10.0444
40′	29′	59.55	1.7749082	3.370	6.717	.846	.635	10.0476
10° 0′	30′	57.59	1.7603298	3.486	6.946	.875	.657	10.0510

THE POTOMAC FLATS.—General Wright, chief of engineers, received Monday afternoon from Major Peter C. Hains, in charge of the work of improving the Potomac River and flats, his monthly report of operations during September and probable operations for the present month.

The report states that dredging operations in the Georgetown channel have been continued under the contract with P. Sanford Ross.

The amount excavated during the month and deposited on the flats was 125,511 cubic yards. The material dredged continues about the same as previously reported.

Below Long Bridge the material when dumped from the cars spreads well out, so that the contractor manages to deposit not less than about 100 cubic yards per running foot of railway.

Above Long Bridge they cannot get more than about sixty cubic yards to the running foot of track without using a force pump to spread it.

The work of building an embankment along the line of the wall, which was to have been commenced on Sept. 15, under the contract with John Van Patten, has not yet been started. Major Hains understands that Mr. Van Patten has become embarrassed financially, which has caused the delay.

The furnishing of riprap stone for the foundation of the slope wall was continued under the contract with Mr. H. P. Gilbert, and 4,000 cubic yards of stone were delivered during the month.

At the upper end of section one (above the outlet sewer) 455 lineal ft. of slope protection has been laid.

Advertisements were issued calling for bids, for the third time, for filling about six acres near Easby's point, the death of Jonathan Taylor, the late contractor, rendering this necessary. Bids were opened Sept. 22, and the award of contract made to Thomas P. Morgan, of this city, at 21 cents per cubic yard.

The probable operations for this month, as stated by the report, will be a continuation of the work of dredging the Georgetown channel and filling the flats above and below Long Bridge. The delivery of stone, under contract with H. P. Gilbert, for foundation of slope protection, will be completed as far as it is proposed to carry it at present.

The work of filling about six acres in section 1, near Easby's Point, will be resumed under contract with Thomas P. Morgan.

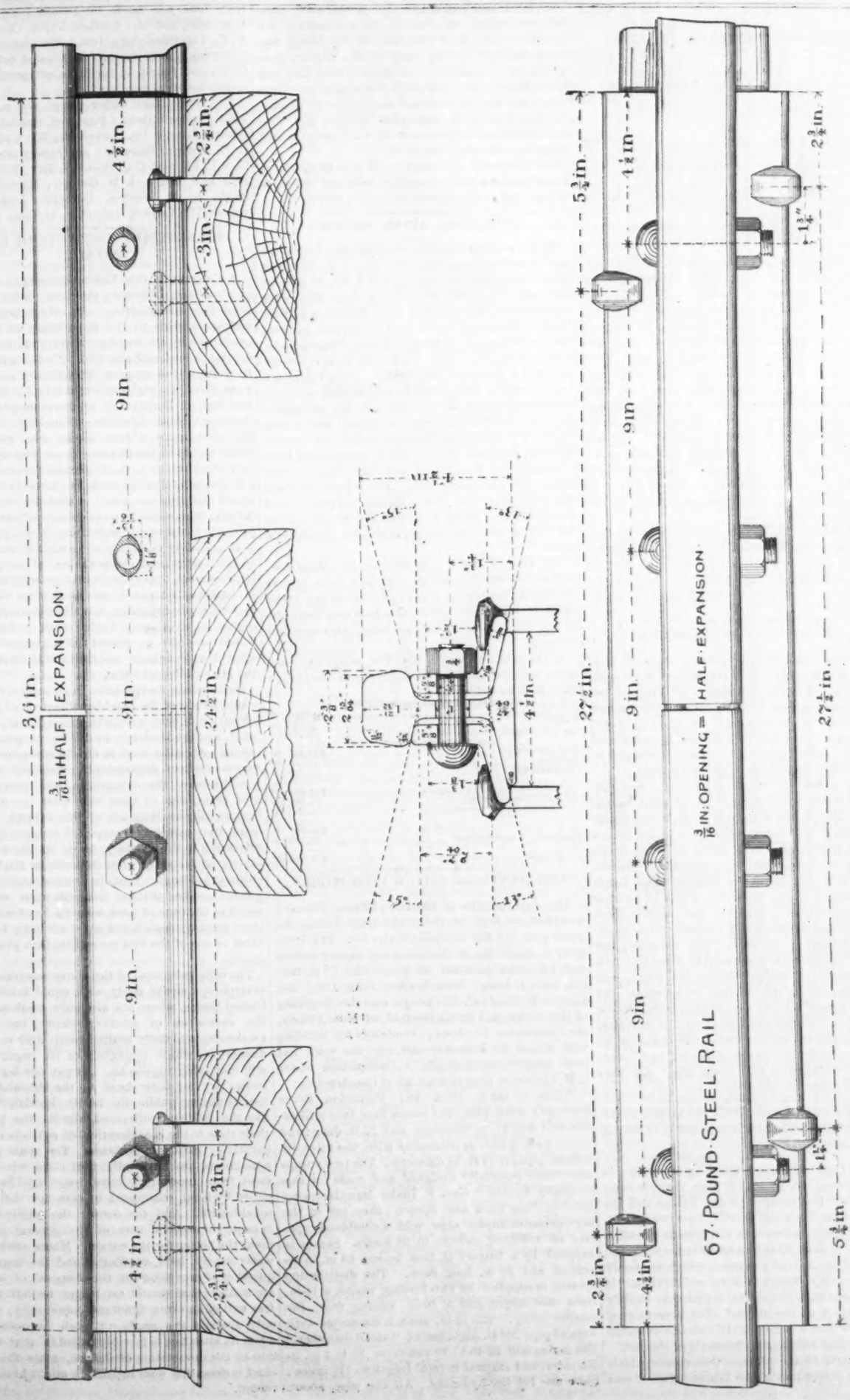
The work on the embankment along the edge of the fill, under the contract with J. Van Patten, ought to be started early in October, but it is not improbable that he will fail altogether.

The American Dredging Company was to have commenced operations under their contract for the removal of rocks in Georgetown Harbor on September 1, but owing to delays in finishing up some work for the Government at Schooner Ledge, Deleware River, the time for the commencement of their work here was extended to about October 1, at which time the work on "Group A," near the Aqueduct bridge, began.

Major Hains has divided the flats improvement work into three sections, as follows: Section 1, above the outlet sewer; section 2, between the Long Bridge and the outlet sewer; and section 3, below the Long Bridge.—*Washington, D. C., Paper.*

WESTERN UNION'S REPORT—At the annual meeting of the stockholders of the Western Union Telegraph Company, held this week, President Norvin Green was in the chair. The president's annual report for the year ending June 30 last was presented and read. It makes no allusion whatever to the company's losses during the strike. It shows a bonded debt of $5,964,204, and gives the following as to the year's business—Surplus, July 1, 1882, $1,664,240; revenues during the year, $19,454,902; expenses, including leased line rentals and taxes, $11,794,553; profits, $7,660,349. Added to last year's surplus this would make $9,324,589. From this was applied for dividends $5,199,124; for interest, $426,817; for sinking fund appropriations, $40,094, deducting all of which leaves a surplus for June 30 last of $3,658,553, represented as follows:—Surplus of net revenue for year over dividends, interest and sinking fund, $1,994 313; surplus at commencement of year as above, $1,664,240. Summing up in round numbers, the net earnings for the year are claimed to have been $7,660,000, out of which $467,000 were paid for interest and sinking fund on bonded debt and $5,199,000 in dividends to stockholders, leaving $1,994,000 (nearly $2,000,000) of excess above dividends and fixed charges to be added to the surplus before accumulated.

LEBANON, Penn., Oct. 9.—The Philadelphia & Reading Railroad Company to-day placed a large force of men to work and environed with tracks the property purchased by Robert H. Coleman, which he had intended using for a station for his new road, recently opened to travel. He is thus prevented from connecting the road with the station. This action of the Reading Company, it is said, was taken because the Pennsylvania Railroad Company is now making surveys through the Lehigh Valley with the intention of extending its new line from Reading to Lebanon, where it will connect with Coleman's road.



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THE CORINTH CANAL.

This canal through the Isthmus of Corinth was commenced in May, 1882. When finished it will be about 21,140 ft. long, at the entrance it will be 328 ft. wide, diminishing to 74 ft., and 26¼ ft. deep. It is estimated that the total quantity of material to be moved will be about 13,000,000 cu. yds. The country traversed by the canal presents three kinds of material: from the Gulf of Corinth for about 4100 ft. it is a sandy alluvial soil; it then passes through a range of rocky hills with cuttings of from 130 ft. to 260 ft., for a distance of 14,760 ft.; beyond this to the Bay of Calamaki, the line passes over a plain with alluvial soil and rocks. The hill portion presents some formidable work, there being nearly 11,000,000 cu. yds. of rock to be excavated; and the contract requires the canal to be finished in three years.

The Engineers are Messrs. Gerster and Kauser. The execution of the work has been contracted for by the *Société des Ponts et Travaux en Fer*, in conjunction with the *Association des Contracteurs*. The contract sum for finishing the canal is 24,600,000 francs.

RAILROAD ADVERTISING.

The sharp competition existing between rival railway companies has had the effect of developing to a wonderful degree the system of railroad advertising in the United States, and new features daily make their appearance. Anything that will attract public attention to the road is considered legitimate, from handsomely framed photographs to the stuffed head of an American buffalo.

Within the week we have received, with the compliments of the Passenger Department of the Chicago, Burlington & Quincy R. R., three elegant little volumes that mark one of the latest phases of railway enterprise. The titles of these books and their general appearance give little indication of their real purpose, one is labeled "The Landscape Wonders of the Western World;" another "the Heart of the Continent;" and each is filled with tastefully designed and well-engraved woodcuts. The text is interesting and readable, but with the illustrations is intended to paint the natural beauties of scenery along the route, and furnish statistical information concerning the States through which the road passes. These publications are certainly useful to the traveler, and are in themselves interesting and beautiful to look at; as to the stereotype claim of each company that their line is the "best line," Mr. Traveler must judge for himself.

THE ELEVATION OF THE ROADWAY OF THE EAST RIVER BRIDGE ABOVE MEAN HIGH TIDE.

This question has been raised by a lawsuit, in which Abraham B. Miller, of New York, is complainant, and the Trustees of the Bridge and the Mayors of New York and Brooklyn are the defendants. Mr. Miller claims that the present elevation of the bridge-floor is not in accordance with the wording of the Act of Congress, which expressly declares that the bridge is to be so built that "it shall not obstruct, impair or injuriously modify the navigation of the river." The Secretary of War decided that a height of 135 feet above mean high water fulfilled the requirements of this act.

In reference to the charge that vessels which could pass safely under the bridge before it was completed have had their spars carried away since the commencement of travel, the engineers of the structure state that "the floor of the bridge has unquestionably settled since it was thrown open to travel; the centre of the span is now four feet lower than it was originally;" but that provision was made for this expected settlement by placing the floor line 189 ft. 9 in. above datum; and, with the settlement complained of, the bridge is still 9 in. above the legal limit.

The difference in elevation of the bridge floor, due expansion and contraction from the influence of heat and cold, is about two and a half feet.

THE EAST RIVER BRIDGE.

At the October meeting, held Monday afternoon last, Superintendent Martin's report showed that since the bridge had been opened 3,385,400 persons had crossed it, 1,865,800 crossing from New York to Brooklyn, and 1,519,600 from Brooklyn to New York. The police force now comprised one captain, one sergeant, three roundsmen, 83 patrolmen, and one property-clerk. There had been 77 arrests and five accidents on the bridge. Nine runaways had occurred; there were two attempted suicides; eight persons had become sick on the structure; two lost children had been recovered; $960 worth of stolen property had been recovered; one person had dropped dead there; three persons had been overcome by heat; and $63 had been found. There was one slight fire. The report also said that the cars were now running regularly, and that there was room now only for the ten cars in use, which were making regular trips on schedule time.

Col. Paine's roller grip was in successful use, and was as much in advance of any other grip as the East River Bridge was in advance of any other bridge. When the other fourteen cars were put in use, they expected to run under two minutes' headway.

In the nineteen weeks that the bridge has been open, the receipts from the traffic over the bridge have been as follows:

FROM NEW YORK TO BROOKLYN.	
Foot passengers	$18,907.00
Vehicles	15,642.00
Car passengers	1,798.00
FROM BROOKLYN TO NEW YORK.	
Foot passengers	$15,467.00
Vehicles	15,931.00
Car passengers	2,138.00
Total from foot passengers	$34,464.00
Total from vehicles	31,563.00
Total from car passengers	3,936.00
	$69,963.00
Expenses of maintenance	51,418.08
Excess	$18,544.92

THE DANVILLE (ILL.) WATER-WORKS.

The city councils of Danville, Illinois, formally accepted, on Sept. 29, the works built during the year past by the Danville Water Co. This company is made up of the following named gentlemen: Samuel A. Miller, of Louisville, C. R. Barret, Geo. J. Long, Wm. Renike, John Long and Carroll E. Gray; C. K. Corbyn was the Engineer of the works, and Frank Shefold, of New Albany, the Consulting Engineer. Contracts for building were closed in February last, and the work has been pushed energetically to completion under I. M. Carson as Superintendent of Construction.

Water is taken from the Vermilion River through a 20-in. pipe, and passes first into a filtering well 40½ ft. in diameter and 27 ft. deep; the pump well, which is connected with the filter by a 20-in. pipe, is 10 ft. in diameter. The two pumps used were especially designed and made for this company by the "Geo. F. Blake Manufacturing Co.," of New York and Boston; they are of the high-pressure duplex type, with a combined capacity of 4,000,000 gallons in 24 hours. Steam is supplied by a battery of four boilers 60 in. in diameter and 20 in. long each. The distribution system is supplied by two forcing mains, a 14-in. from the larger and a 10-in. leading from the smaller pump. The 14-in. main is connected with a stand-pipe 200 ft. high, but of "small diameter." The mains laid in the city run from 10 to 4 in. in diameter, and amount in total length to 13¾ miles; there are 101 fire-hydrants. All the pipe, about 1,500 tons, was made by Dennis Long & Co., of Louisville, and the Ludlow Valve Co., of Troy, N. Y., furnished the valves. The pumps and distribution system were severely tested before acceptance, and found to fulfill in all particulars the requirements of the contracts.

The contractors under whom the works were built were as follows: Pipe and Special Castings, Dennis Long & Co., Louisville, Ky.; pipe laying, L. M. Brown, Danville; machinery and boilers, Geo. F. Blake & Co., Boston & New York; stand-pipe and house, I. M. Hankey, Danville; brick-work, P. M. Norton, Danville; hydrants and valves, The Ludlow Valve Co., of Troy, N. Y.

THE SANITARY INSTITUTE OF GREAT BRITAIN.

A Congress of this Institute was opened at Glasgow on Sept. 25th last; the Hon. John Ure (the Lord Provost) presiding. Dr. Humphreys in his address referred to the importance of the work carried on by the institute in its relation to health, mental, moral, and physical. He thought it would be well for the country if increased opportunity were given to sanitary engineers in Parliament and out of Parliament to more deeply impress their convictions upon the community. Were this influence more widely spread one anticipated result would be the institution ere long of a Sanitary Department in the Legislature of the country, a department distinct from the Local Government Board and directly under a Minister of Sanitary Affairs, who would have in charge all that might promote the personal well-being of the people; see to the sanitary condition of cattle, in the interest of agriculture, and the reduction of the price and improvement of the quality of animal food; and investigate and check the disease to which our various food-producing plants become liable under higher cultivations. Under such a department would properly be placed the Registrar-General's office, the Ordnance and Geological surveys, and the Meteorological office.

Harmonious co-operation in all sanitary matters would be one of the chief benefits derived from the formation of such a separate governmental department, and the tendency would be to promote an official sympathy that is now wanting among the various distinct departments. Sanitary engineers would receive the recognition, now partially denied them, due to men who have devoted their lives to the consideration of this subject, Parliament, too, would be compelled to give due consideration to the sanitary needs of the nation—a matter of far more vital importance than "agricultural holdings," "criminal procedures" and the greater number of those subjects upon which so much of the time of past sessions has been spent. Good sanitary legislation must ere long be recognized as one of the first necessities for a prosperous people.

The solid substance of the above remarks of Dr. Humphreys would apply with equal force in the United States, where we are only awakening to the necessities of sanitary science; but we are awakening and daily realize more and more the dangers to which a neglect of its requirements will inevitably expose us. As yet our legislative bodies pay but little heed to the demands of a long-suffering public for health legislation, and, like the British Parliament, devote the bulk of their time to the consideration of subjects of comparatively minor importance. The mass of our population, and especially that class who suffer most from unsanitary conditions, must be compelled by legal enactment to care for their personal health. And the sooner the public health is made the especial care of the general government the better for the nation. House sanitation, water supply, food, ventilation and the important question of providing for the disposal of sewage are matters that should no longer be left to the free will of an often ignorant community, which only realizes the needs of such improvements when its attention is forcibly called in that direction by the devastation of disease, after the mischief is done that wise legislation might have prevented.

STORM-WATER DISPOSAL.

In calculating the cross-section of a sewer required to drain some fixed area, the disposal of the storm-water flow is a factor of great importance in estimating the cost, and a puzzling one in fixing maximum amount of flow. Some "authorities" contend that *all flow* from the drained district should be carried away by the sewerage system to the outlet of the latter; that to permit its discharges into inlying streams results in contamination of these streams. We think this position a false one, and that a proper economy and common sense point decidedly toward a different method of treatment under average circumstances.

Rainfall acts as a scavenger in washing the air and scouring the streets, courts, yards and roofs of the district affected. If this district is very densely populated the rain-flow from its surface may be as impure as the matter usually passing through its sewers; and in such exceptional cases especial provisions should be made to remove a certain portion of the rainfall by means of the sewers. In London this amount is fixed at one-quarter of an inch in depth over the whole area drained every twenty-four hours, at the time the maximum flow of sewage is being discharged; any surplus is dealt with by means of storm-water overflows communicating with the Thames.

The system that will apply to one of the most densely populated cities in the world will also apply in principle to our smaller towns, although we know of instances where money has been wasted in an attempt to do otherwise. With the provision made for carrying away the first surface flow any further quantity of rainfall must be practically harmless, and can be safely discharged into the nearest stream. This is especially the case in smaller towns, where the surface refuse approaches neither in quality or quantity that found in large cities.

To attempt to provide for all *possible* rainfall generally results in failure, because we cannot fortell the "possible." And in addition to the waste of money in building a sewer that for nine-tenths of the time is too large for the duty expected, the very purpose of the sewer is destroyed by reducing the depth of flow, under normal conditions, to such a degree that the resulting velocity is insufficient to remove the solid and more dangerous matter.

In Boston, under the elaborate and extensive sewerage system now about completed, all sewage must be raised by pumps a distance of 42 ft. before it can be discharged. In this case, as in all well-designed systems, storm-water overflows are liberally provided for; had the reverse been the case the enormous increase in pumping and consequent outlay for plant and maintenance could hardly be estimated.

The arrangement of overflows is simple, and, compared to the increased cost in section, is very economical. The only remarkable thing about them is that objectors should be found to their adoption.

THE MERSEY TUNNEL.

From an interesting paper read before the British Association by Mr. Chas. Douglas Fox, C. E. one of the consulting engineers, we gleam the following particulars relating to the Mersey Tunnel. The company was organized as at present constituted in 1881, with the Right Hon. Henry Cecil Raikes as chairman, the Right Hon. E. Pleydell Bouverie as deputy-chairman, Major Isaac and Mr. John Waddell as contractors, and Mr. James Brunlees and the author as engineers. The length of the railway is 3 miles 8¼ chains, of which almost the whole is either in tunnel or covered way, and it is being constructed for a double line throughout, the works being arranged for trains every five minutes each way, the traffic being expected to be very large. The land works do not call for special remark, being to a great extent in tunnel through sandstone rock under the public streets. For the purpose of the works under the river two shafts have been sunk on each side of the Mersey one being for pumping purposes and for communication with the drainage heading hereinafter mentioned, and having a depth of about 180 ft.; the other for winding and ventilation from the main tunnel, and about 90 ft. deep. These shafts are lined partly with brickwork and partly with iron tubing. From near the bottom of each of the pumping shafts a drainage heading, rising slightly toward the center of the river to allow the water to run to the pumps, is being driven partly by hand and partly by Colonel Beaumont's boring-machine, which cuts a circular heading 7 ft. diameter. Out of a total of 1,774 yds., 1,143 yds. have already been driven, up to September 5, 1883. The sandstone rock through which the works are carried, though hard and compact, is porous, and yields more or less water. The pumping machinery on each side consists of two 20-in. and two 30-in. sets of bucket lift pumps, driven by compound engines by Hathorn, Davey & Co., of Leeds. A 40-in. set of plunger pumps, to be driven by an overhead engine by Messrs. Barclay & Sons, of Kilmarnock, is now being fixed as a duplicate on each side. The 30-in. sets have hitherto been found amply sufficient to clear the works. The main tunnel excavation has now advanced 1,590 yds., closely followed by the brickwork.

Col. Beaumont supplemented the paper of Mr. Fox by a short statement of the work previously done by his boring machine. A distance of 5,000 lineal yards was driven with it in the Channel Tunnel through hard chalk. The greatest speed that had been attained with it had been—more as a *tour de force* than with any idea of keeping it up—one foot every ten minutes, and this speed was kept up for two hours; so that the capacity of the machine for boring through the hardest chalk, requiring blasting, might be taken to be at the rate of 48 yards in every 24 hours. The speed which he anticipated getting, and which he had every reason to believe would be got before the machine has completely perforated the rock under the Mersey, was 1 ft. per hour, or 8 ft. in eight hours. It might be asked why there should be this enormous difference in speed. The reason was the necessity for changing the cutters more frequently in cutting the hard sandstone rock than in cutting the softer chalk, in consequence of the greater heat developed. In the softer chalk from 16 to 20 ft. could be cut without changing the cutters; but in the sandstone rock the greatest distance that could be cut without changing had been 18 in., and it had been brought down as low as 3 in. This latter figure, however, was not due to the hardness of the rock, but, to a certain extent, to the want of proper temper in the tools and to the fact that ice was forming in the engine, and consequently a regular action was not imparted to the cutting tools. For a more detailed description of Col. Beaumont's machine we refer readers to our issue of May 26, 1883. The machine had been tried in the hardest sandstone, and with the most perfect success, so far as demonstrating the possibility of the application of the system to the cutting of the harder rocks.

THE TEHUANTEPEC RAILWAY.

As the result of an interview with Chf. Eng. E. L. Corthell, we give the following as the latest official information concerning the plans and prospects of the Tehuantepec Ship Railway.

Martin Van Brocklin, the company's Resident Eng., has lately returned from the Isthmus and with a dozen assistants is busily engaged in working up the notes of his survey, which was commenced on the 20th of last March and completed on Aug. 17. This survey is remarkable in being the first complete connected instrumental survey ever made across the Isthmus. All preceding schemes have been based upon a patchwork of partial surveys and general reconnoissance. Mr. Corthell remarked that the results of this work are very gratifying. To use his own words: "We are happily disappointed in these surveys; they are better than our most sanguine anticipations." A personal examination of the profile shows a line, for the greatest part of the way, that would be classified as "light work" even in a prairie country; the heavy work is all practically concentrated toward the Pacific end, and the deepest cutting, which is about 175 ft., is short in length, and admirably adapted by its position for furnishing the rocky material required for the construction of a sheltering mole or breakwater in the harbor.

The total length of the line from Minatitlan on the Gulf side to Salina Cruz on the Pacific is 153 miles. For 60 miles out of Minatitlan the country traversed is an alluvial plain, with abundant timber and a fertile soil; the next 20 miles is a gradual ascent up a wide valley to the foot of the main divide; within the next 33 miles comes all the heavy grading, but no exceptionally difficult work is encountered. The remaining 40 miles to Salina Cruz are over a level plain.

The maximum grade will not exceed one per cent. and this grade is limited to a distance of four miles on the Atlantic side and eight miles on the Pacific side of the divide. The alignment is remarkably good, considering the purpose of the road and the country passed through, and Engineer Van Brocklin and the company are both to be congratulated.

Some radical changes have been made in the system proposed for transferring the ships from the water to their position upon the railway, and in the transporting cradle itself. The cross section of the cradle now shows a strongly built iron girder, supported by spiral springs, upon four sets of wheels running on four rails; the wheels are about 26 in. in diameter, and spaced 3 ft. apart longitudinally. One of the original stumbling blocks was the difficulty of adjusting the cradle to the various outlines of the hulls to be transported; this is now provided for by the addition of two small auxiliary girders, one on each side of the hull, each lying in the line of the main girder and hinged to it at the inner end; the outer ends of these auxiliary girders carry pivoted bearing blocks, and by the medium of an elevating screw passing into the main girder these blocks can be accurately fitted to the hull by raising the outer ends of the small girders.

For placing the ships upon the railway, a vertical hydraulic lift is to be used with an accumulator of enormous power, the designs for which are now being worked up in the company's office. The ship will be run directly over the cradle, and cradle and ship lifted bodily to the level of the railway. This plan is to replace the incline originally contemplated.

Complete estimates of cost, and both general and detail plans are now being prepared as rapidly as possible; these are all to be finished by Oct. 23, when Capt. Eads, together with Col. Jas. Andrews, Hon. A. G. Cochrane and Resd. Engineer Van Brocklin will sail for Liverpool. Leading English capitalists have been anxiously awaiting the presentation of accurate surveys and estimates: and as the party take these with them it is expected that a company will be formed immediately upon their arrival in England for building the Ship Railway.

In connection with this subject we might mention that the use of Capt. Eads' name has been solicited by certain English capitalists and engineers in a project for building a Ship Railway across the Isthmus of Suez. It is said that such a railway could be completed in two years for the sum of $25,000,000.

THE RAILROAD SAFETY LOCK AND SIGNAL COMPANY.

This is veritably a day of wonders in the continual advent of new and startling inventions. The latest device brought to our notice for the protection of the traveling public is the one owned by the company named above; and in the advantages claimed it far surpasses any of its predecessors.

This new application of electricity and mechanics is known as the "Shaffer system" of signaling; it is entirely automatic in its working, leaving literally nothing to human agency in the care of the

traveler upon our railroads, save the ordinary care and attention required in keeping in order the batteries and wires, and even in case of the failure of either of these from neglect, the danger signals are automatically worked and the train stopped as will be described.

The system is used in connection with, or rather embodies, the "Block Signal System" now in use on our main lines. Its action and appliances to bring about the results attained may be briefly described as follows: Electricity is the motive power. Dynamo machines at interval of about 20 miles supply this through the medium of two sets of wires on a double-track road, and four sets when a single track is used. The line is divided into convenient "blocks," and at each of the dividing points alongside the track is placed an elevated cast-iron box, surmounted by a signal, and containing the mechanicism for working this signal, and effecting the actual stoppage of trains, if there is danger ahead. It is in this latter feature that this invention is ahead of other signalling devices, and the following is the method in which it is accomplished: just inside of one of the rails in the track is a hinged lever about six feet long, so arranged as to be free from obstruction from ice or snow; it shuts down in a box of angle-iron, like a knife blade in its handle. This lever is operated by a rod from the signal-box. If the line is clear it always remains down, but if a train, for instance, is still on the "block" ahead, the danger signal on the box is displayed, and the one end of the track-lever is raised; if the engineer of the approaching train persists in disregarding the signal, and attempts to run his locomotive beyond the signal-box, a hinged bar which is attached to the rear axle-box of his engine will strike the incline of the track-lever and be thrown back by so doing. This action, through a most ingeniously contrived valve mechanism, opens this valve and permits steam to pass to a small vertical steam cylinder attached to the front of the engine boiler. The piston in this cylinder descends, and acting by a wire cord upon the throttle valve, closes the latter, shuts off the steam, and at the same time operates the whistle. We should mention, too, that the same movement which turns on the steam to the throttle cylinder also partially puts on the air-brakes on the train. The train cannot again be started until the engineer presses down a foot-plate in the floor of his cab, which brings all the mechanism back to its starting-point, ready for a second "block." The electric power required to bring about this really simple but important result is not in volume as many might suppose. The electric box is a strongly built affair and contains a stout vertical "lock-bar" which is swung the short distance required by a magnet and its armature. If there is danger on the line; in other words, if the proper signal has not reached the box through the second or "circuit-closing" wire, automatically recording the fact that the train which has passed this particular box is still on the block beyond; this "lock-bar" remains in position to raise the track-lever upon the approach of a train. We should have explained that to prevent tampering with the track-lever, either by unauthorized parties or by accident, a guard-rail is placed on the outside of the rail, and projecting slightly above the level of the rail, so that it may be depressed by the weight of the engine. As nothing but a weight of some thousands of pounds can move it, it is safe from interference during the absence of trains, and if the block ahead is clear the depression of the guard-rail is void of result; but if the "lock-bar" in the signal-box is still down, the wheels of the pilot on the engine will raise the track-lever into position to be struck by the swinging-bar on the rear axle of the locomotive.

The "lock-box" is released by the breaking of the electric circuit, when it is raised by a counter balance-weight; the circuit is broken by a simple device which is attached to the equalizing bar on a truck of the last car in the train. This "circuit closer" can be applied to any truck in a few minutes, and consists essentially of a short swinging arm or bar hinged at the top, and so stopped that in going forward it must strike and depress a short inclined lever just outside the rail, which is connected by a rod with a signal mechanism; in backing a train neither the bar on the engine nor the "circuit-closer" operate their respective levers, being free to swing backward.

The mechanical action upon a single-track road is the same as that just described, but as the "feed wire" and "circuit-closing wire" must be duplicated, as well as the track-levers and circuit closers, so as so catch trains going either way, the system becomes more complicated, though just as certain in its working.

The company have been experimenting extensively during the last year, and have the invention in actual operation upon a short section of the Philadelphia & Atlantic R. R., near Philadelphia, though hardly under conditions favorable to fairly testing its merits. But with the improvements suggested by these trials, they now believe it to be perfect. Mr. Wm. C. Shaffer is the inventor, and the manager of the company.

The system includes provisions against almost all conceivable and even inconceivable dangers, such as the blocking of track in a tunnel by a falling roof, open draw-bridges, land-slides along the line, open switches, etc.; and in one especial particular provides for safety when all other signals under the guidance of man fail, and that is in the breaking of a train. As will be seen from the descriptions, until the *last car* of the original train with its "circuit-closer" leaves the "block," the danger signal must be displayed and the stopping mechanism remain in operation.

BOOK NOTICES.

"The Elasticity and Resistance of the Materials of Engineering." By Wm. H. Burr, C. E., William Howard Hart, Professor of rational and technical mechanics at Rensselaer Polytechnic Institute. John Wiley & Sons, publishers. [Price $5.00.]

Prof. Burr has divided his matter into two parts: the first he calls the "Rational," and intends it as a rational or analytical basis for an introduction to the "Technical" or practical development of the subject as embodied in Part II. Part I. is almost purely mathematical and is avowedly designed for few others than the technical students, whose tastes induce, or circumstances require minute and complete investigations in connection with the elasticity and resistance of materials.

The practical value of this new work lies in the 2nd part, which is the bulkier portion of the volume. In this section the mathematical results obtained in Part I are subjected to the test of experiment, and the results of these experiments, while they are compilations only, have been in all cases taken from the most trust worthy sources, and the authorities are given for each. The tests given are numerous, and apply to the limit of elasticity, ultimate resistance, permanent set, etc., of wrought iron, cast iron, steel, and various other metals. The chapter on compression includes experiments upon the metals and upon brick, cement, building stones and timber.

In compression in long columns, the various formulæ of Gordon, Euler and Tredgold, Hodgkinson and C. Shaler Smith are investigated, and the results illustrated by tables of experiments and diagrams of strains. Shearing torsion, bending, and connections receive due attention, the questions connected with them being discussed at length.

Under the chapter heading of "Working Strains and Safety Factors" specifications and selections from specifications are given, under which were built a number of the later and more prominent bridges in the United States, including the East River Bridge.

The entire work is bulky, having nearly 800 pages of printed matter; and emboyding as it does the results of numerous actual experiments and the expressed opinions of nearly all the ablest authorities upon the elasticity and resistance of material, it must find its way into the hands of engineering students. In itself it is a monument of patient labor and technical and mathematical knowledge on the part of its author.

PERSONAL.

RESIDENT ENGINEER ENGSTFELD, at West Pearl River, Pa., has recovered from his illness.

F. J. AID is Chief Engineer of the Columbus & Eastern R. R., with office at Columbus, O.

MR. A. V. GUDE, now of Atlanta, Ga., formerly Chief Engineer of the L. & N., was lately in Louisville.

THE Neuchatel Asphalt Company, of 54 Astor House, were awarded a gold medal at the exhibition at Amsterdam.

JOHN C. GAULT, after consultation with Col. HOXIE, of the Gould roads, has finally declined the Commissionership of the California pool.

J. H. CABLE, of Lafayette, Ind., has accepted the position of superintendent of construction of eighty miles of the Northern Pacific Railway, with headquarters at Superior, Wis.

WILLIAM HENRY MUSSEN, Montreal City Cashier, has absconded, having embezzled a large sum from the treasury of the corporation. The actual amount of the defalcation is unknown.

LIEUTENANT F. V. ABBOTT, of the Engineer Corps, has been directed by the Secretary of War to run the boundary lines between Maryland and Virginia. The detail was made at the request of the Governors of those States.

MR. SAMUEL E. BARNAY, Asst. Engineer on the N. P. R. R. has been appointed to the professorship of Civil Engineering in the Sheffield Scientific School of Yale Colloge, made vacant by the recent death of Prof. W. A. NORTON.

MR. JAMES GOODWIN, a prominent Canadian contractor, died at Montreal on the 1st inst., aged 64. He was the contractor for the Grenville Canal, and also for the Trent Canal, now in course of construction, and which work will be continued by his nephew.

A. K. OWEN, engineer, and the advance guard of the corps of engineers of the American & Mexican Pacific Railroad, arrived at Guaymas recently, and were to leave for Topolobampo, their initial point on the Pacific Coast, as soon as the balance of the party arrived.

ENGINEER T. W. SEWELL, of the Wisconsin Central Railroad, and wife, have arrived at Ashland, Minn., where MR. SEWELL intends to make his headquarters the coming winter. He expects soon to be actively engaged on the Ashland & Montreal Iron Range Railroad.

THE following named persons have recently filed applications for appointment to the position of supervising architect, to succeed MR. HILL: ARCHIMEDES RUSSELL, District of Columbia; J. R. THOMAS, of New York, and GEORGE W. SEASE, whose residence is not stated.

COLONEL T. M. R. TALCOTT, general superintendent and manager of the Richmond and Danville Railroad, has resigned, after a fifteen years' connection with the road. He will be succeeded by Colonel A. L. RIVES, first vice-president. The change is owing to the new ownership of the road.

TRENTON, N. J., Oct. 9.—The commission of JOHN J. HALL, the absconding Middlesex County Freeholder and PensylvaniaRailroad civil engineer, as captain of Company D, Third Regiment National Guard, was to-day declared vacated by Gov. LUDLOW. HALL is said to be hiding out West, having left over $50,000 of debt unsettled in New Jersey.

"MR. R. L. FOX," says the Albany (N. Y.) "*Morning Express*, has succeeded to the position of Deputy State Engineer, made vacant by the resignation of Mr. E. D. SMALLEY. Gen. SEYMOUR is to be commended for his good judgment in the appointment, as it was a most excellent one, and was, moreover, eminently proper, as Mr. FOX was in the direct line of promotion."

THE death was recently announced in England

of Mr. GEORGE REMIGTON, the engineer who in 1840, in conjunction with his father, projected the first metropolitan railway, called the Grand Junction Railway, which was to run from Snow Hill, Holborn, by way of King's Cross to the West of London. His project for a Channel tunnel, published in 1864, was the commencement of the present movement in this direction.

MR. MARK M. ("Brick") POMEROY says that he now knows nothing of politics. He is engaged upon the tunnel in the Rocky Mountains, which must go twenty thousand feet further before it is through, and on which there has already been work for two years. This tunnel, which the once baked-clay Democrat expects to see finished in three years, he says will shorten the distance between Denver and Salt Lake something like two hundred and thirty miles.

MR. TRUMP, assistant engineer of the Pittsburgh Division of the Pennsylvania Railroad, has been promoted to assistant superintendent. The following changes and promotions have followed Mr. TRUMP'S appointment: A. P. GEST, assistant engineer of the Monongahela Division (P., V. & C.), to be assistant engineer of Pittsburgh Division; JOHN BROTHERLINE, assistant engineer of construction of the West Pennsylvania, to be assistant engineer of Monongahela Division, and SAMUEL REA to be principal assistant engineer assigned to duty in the office of Third Vice-President J. N. DUBARRY.

MR. ROBERT H. SAYRE, of Bethlehem, Pa., has been appointed Chief Engineer of the American Construction Company, which has taken the contract to build the new South Pennsylvania Railroad between Harrisburg and Pittsburgh. Mr. SAYRE was formerly Chief Engineer and General Superintendent of the Lehigh Valley Railroad Company, and brings to his work in his new field a wide experience of railroad engineering. Mr. OLIVER W. BARNES retains his position as Consulting Engineer. The contracts for the seven tunnels on the new road will be awarded very soon, Mr. SAYRE says, probably within ten days.

APPOINTMENTS.—The management of the Cincinnati, New Orleans & Texas Pacific road makes the following changes:

Mr. C. BRECKINRIDGE, having resigned his position as engineer, to take effect on Oct. 15, 1883, Mr. A. PETRY will act as Resident Engineer for the Alabama Great Southern Railway.

Mr. W. H. HARRISON will act as Resident Engineer for the Vicksburg & Meridian Railway.

Mr. M. WALSH, now Superintendent of Bridges and Buildings, is appointed General Superintendent of Bridges and Buildings on the Cincinnati, New Orleans & Texas Pacific, Alabama Great Southern, Vicksburg & Meridian, Vicksburg, Shreveport & Pacific, and New Orleans & Northeastern railways.

DURING a recent visit to Gartsherrie, the great Baird Iron Works on the Clyde, whose profits have made the four brothers of that name colossal landed millionaires, and whose Pactolus stream to-day enriches so many families who have linked themselves to Gartsherrie by marriage, Mr. CARNEGIE, of Pittsburgh, Pa., quietly remarked that it was "a nice little foundry." The Gartsherrie people, with some natural indignation, asked him where by chance he could find a bigger. "Why," said Mr. CARNEGIE, with imperturbable serenity, "I own a bigger myself." A bet was made. A Gartsherrie representative went back with CARNEGIE to Pittsburgh, and the outcome of the inspection there was that the American had won the bet.

MR. CHARLES C. UPHAM, the new chief engineer of the Tampico Division of the Mexican Central, who was appointed August 19 to succeed Major HARRINGTON, has his headquarters in Tampico. Mr. UPHAM is only 32 years old. He was a member of the Atchison, Topeka & Santa Fé engineer corps, which has graduated some of the most brilliant engineers in America. After much experience in Colorado and New Mexico he was engaged on the Northern Division of the Mexican Central, locating the line between Paso del Norte and Chihuahua. He was offered the chief engineership of that division, but declined on account of the superintendent, at that time ex-Gov. ANTHONY of Kansas. He has since had charge of the locating of the mountain line on the Tampico Division.—*Mexican Financier.*

THE REV. DR. FERDINAND C. EWER, of St. Ignatus' Church of this city, who was stricken with paralysis, on Sunday morning last, in the pulpit of St. John's Episcopal Church, Montreal, Canada, resulting in his death on the 10th inst., was born in Nantucket, Mass., May 22, 1826. In 1844 he entered Harvard University, where he made a special study of mathematics. He graduated in 1848, and at once found employment as a civil engineer on the Boston & Fitchburg R. R. In 1849 he landed in California, after a trip around Cape Horn, and failing to find employment in engineering betook himself to journalism. He was originally a Unitarian in belief. He left Harvard an avowed atheist, but from engineering, gold-digging and journalism he entered the ministry to become one of the most zealous exponents of Ritualism, in which faith he died.

AMASA STONE, the Cleveland millionaire, is thus spoken of by Gath: "HARBACH, who made surveys on the first railroad from Cleveland, the Cleveland, Columbus & Cincinnati, brought out with him AMASA STONE. I think he was a bridge builder, and had got an interest in the Howe patent bridge. My impression is that he was not a particularly bright man. I can only remember one remark he made that showed any genius for general observation, and that he said over and over again. It was that one man had to think for fifty. He had but little range of mind and worked steadily within narrow limits, striking hard blows in the same spot and continuously. He seemed to have the secret of making money by not going outside of the narrow limits which accumulated. As he lived a good many years, of course, he became very rich. I have always considered that his large fortune was acquired by finding accidentally the true spot to settle down and not to leave it."

SAMUEL REA of Pittsburgh, Pa., who has just been appointed Principal Assistant Engineer of the Pennsylvania Railroad, with headquarters at Philadelphia, comes to that office from the new line of the Western Pennsylvania R. R., where for the past three years he has been engaged in lowering the grades of the old line so that it may be used for the transportation of some of the freight which now burdens the main road. The successful completion of the tunnel on the West Penna. R. R., under Mr. REA'S direction, only recently completed, is an achievement of which any engineer may be proud. Prior to undertaking this work, Mr. REA supervised the extension of the Pittsburgh, Virginia & Charleston R. R. southwest from Monongahela City. He went to that work from the Pittsburgh & Lake Erie R. R., in the construction of which he was engaged. Previous to his work upon the last named railroad Mr. REA was the Assistant Engineer in the construction of the Point Bridge across the Monongahela River in Pittsburgh. Mr. REA, who is not yet thirty years of age, is a grandson of Gen. JOHN REA, who represented the Franklin-Bedford (Penn.) District in the VIIIth, IXth, Xth, and again in the XIIIth Congresses.

OBITUARY.

GEN. GEORGE WEBB died at Johnstown, Pa., on the evening of Oct. 9. His death was caused by paralysis of the brain. General Webb was born in Muncy, Lycoming County, Nov. 4, 1828. He taught school and educated himself in civil engineering. In 1850 he went to the lead-mining district of Wisconsin. About 1852 he surveyed the northern boundary of that State for the Government. The district was a vast wilderness and he suffered great hardships. From 1856 to 1860 he was city engineer of Dubuque, Iowa. In 1860 he negotiated with Jefferson Davis for the building of levees on the Mississippi, but, the war breaking out, he gave up all contracts and entered the Union army as captain of a company from Hughesville, Lycoming County,

From 1862 to 1872 General Webb was Chief Engineer and General Superintendent of the Catawissa Railroad, and he lived in Williamsport during this time. He was also Chief Engineer of the Baltimore & Potomac road and constructed the large tunnel under Baltimore. In 1872 he was appointed Assistant General Manager of the Pan-Handle Railroad, and great credit has been given him in bringing that road to its present high standard. In 1874 he was appointed to the same position on the Fort Wayne Railroad. In 1875 he was appointed general agent for the Cambria Iron Company. He had full control of all the tests of steel made by this company for the Brooklyn Bridge. In 1857 he married Miss Emma Alden, of Muncy, who, with three sons and three daughters, survive.

CORRESPONDENCE.

IT IS NOT A "SOLID."

STILLWATER, Minn., Sept. 29, 1883.

EDITOR ENGINEERING NEWS:

DEAR SIR: I have an interesting bet here that a base-ball is "not a solid body of matter," and would like your opinion in regard to it.

Of course, I understand it is composed of solids, in the general acceptation of the term solids, but by mechanically pressing the yarn and putting a cover over to hold it in shape, that it is not a solid, as it is not held together by cohesion of the molecules, and therefore is no uniformity of matter—the principle of solids, as I take it.

Very respectfully,

H. H. HARRISON.

(Webster sufficiently defines a solid.)

PROBLEM IN SURVEYING.

PITKIN, Colo., Oct. 2, 1883.

EDITOR ENGINEERING NEWS:

Traverse.	Feet.	Traverse.	Feet.
1. N. 75° E.	300	6. West	300
2. S. 15° E.	722	7. North	806.38
3. South	765.5	8. N. 30° E.	645.62
4. S. 30° W.	645.62	9. North	645.62
5. South	720	10. N. 15° W.	986.50

To find total latitude (according to Van Nostrand) of each station add to the total latitude of preceding stations the latitude of preceding course. If the latitude of last station found in this way be equal to latitude of last course with reversed signs the work is correct. The latitude of first station is always zero; the latitude of last station is always that of last station with reversed sign, and of second station it is the latitude of first course. To find the adjacent departures add the departure of each course, one on each side of station. I would like to see the above applied to the example furnished.

C. E.

NEWS OF THE WEEK.

THE SOUTHWEST PASS (LA.).—The British steamer Wellfield came in lately through the Southwest Pass to New Orleans. Sixteen feet of water was reported, and but for the sills laid therein some years ago by Capt. Eads, to divert the current of water into the South Pass, a much deeper channel would be available.

THE Northampton (Mass.) Reservoir is nearly completed and the cost is only $18,000. It is 45 ft. high in all, 30 above water, 23 ft. wide at the bottom and 5 at the top, the whole being built in a circular form. The work was done under the supervision of Engineer Davis.

BOONE (IA.) WATER-WORKS.—The new waterworks will cost $18,000.

THE Conway (Ark.) and Des Arc Railway survey is now being made. The road will be built within twelve months, New York and Boston parties having agree to furnish the necessary capital. It will open up a heretofore inaccessible and very fertile portion of the State.

HARPER HOSPITAL.—This fine structure, now nearly completed, will be one of the largest and finest appointed hospitals in the United States. Its cost is $100,000. The architect is E. E. Myers, of Detroit, in which city the hospital is. The general plan of the building is that of a long, high, comparatively narrow structure, with three cross sections—one at each end and one in the middle, the latter the largest. The building extends north and south along Brush street, Detroit, and parallel with it. It is 236 ft. long, and 48 ft. through from front

to back. The cross sections extend front and back at right angles with the main building or hall. The depth of the end sections, from front to back, is 88 ft.; width, 30 ft.; depth of middle section, 160 ft.; width, 52 ft. The center of the building, and the front extension of the middle cross section, are five stories. The general height of the building is 58 ft.; of the center and front extension, 69 ft.; height of central tower, 106 ft.; of end towers, 88 ft.

INDICTED.—Trenton, N. J., Oct. 8.—The Mercer County Grand Jury came in to-day with forty bills of indictment, among them being one against the city of Trenton for maintaining nuisances in the disease-breeding stream known as "Pettis' Run," which runs through the city, and also in Hankinson's alley. These places have for a long time, on account of their filthy condition, been detrimental to the city's health, and despite numerous complaints from citizens the city authorities took no steps to abate the nuisances. As a last resort complaints were made to the Grand Jury, with the result above stated.

ALLIANCE (O.) WATER-WORKS.—These works, just completed, will be tested to-day (13th) by the contractors, Messrs. J. A. Cloud & Co., of 18 Broadway, this city. It is a gala day in Alliance.

ELECTION OF OFFICERS.—Atchison, Kan., Oct. 8.—The Atchison (Kan.) Water Company held its annual election of officers and directors on the 8th in that city. The following directors were chosen: John R. Lyonberger, Thomas E. Luts, Charles Parsons, John D. Davis, James H. Sheets, Edward Whitaker, all of St. Louis; J. P. Brown, R. A. Pork, and I. B. Platt, of Atchison. John R. Lyonberger was elected president, J. B. Quegley treasurer, and Superintendent J. D. Davis secretary.

THE NEW OHIO RIVER BRIDGE.—Louisville, Oct. 8.—Work on the new Ohio river bridge, between Louisville and New Albany, discontinued a year or two ago, will be resumed to-morrow. A strong Eastern financial backing has been obtained. The first efforts will be to save the piers already constructed. The contract for the iron work has been let to the Delaware Bridge Company, of 52 Wall street, N. Y. The contracts for stone have not been let, large quantities being on hand.

SIX CONTRACTS have been let on the Arizona Central, and it is now intended to finish work by the 1st of June next.

ACCORDING to the *Railway Age*, 4,244 miles of railway track were laid on 190 lines during the nine months ending Sept. 30, 1883. During the corresponding period in 1882, 8,075 miles of track were laid on 260 lines.

THE LIDGERWOOD MANUFACTURING COMPANY. No. 96 Liberty street, New York, who are the most extensive manufacturers in the country of hoisting machinery, having the largest and most complete works in that line, have wisely determined to be represented in Baltimore by the leading machinery agency house in that city, and hence have placed an agency for their goods with Messrs. Morton, Reed & Co., who are so well and favorably known to the trade of the North and South as to scarcely need any further commendation. The hoisting machinery of all kinds manufactured by the Lidgerwood Company is constructed in the most substantial manner, and is adapted to meet the requirements of all lines of work.

THE National Association of Stationary Engineers, at Chicago, last week, elected the following officers: President, James G. Beckerleg, of Chicago; Vice-President, R. J. Kilpatrick, of St. Louis; Secretary, A. M. Davy, of Detroit; Treasurer, George M. Barker, of Boston.

DEATH OF AN OLD RAILWAY MAN.—Cleveland, Oct. 7.—William Franklin, Master of Transportation for the Ohio division of the Baltimore & Ohio Road, fell dead in the street, at Newark, Ohio, on Saturday. Heart disease was the cause. He had spent his whole life in the railroad business, beginning as fireman, and for the past 12 years he had been in the employ of the Baltimore & Ohio.

PROFESSOR HUGHES finds that the critical state of soft iron, when it ceases to be attracted by a magnet, is reached just as the iron is heated to a yellow white, or between white and red heat. Steel also loses its power of being magnetized when heated, and on being cooled 100° below zero loses it again. Nickel similarly parts with its magnetic property at the very low temperature of boiling water.

SAVANNAH HARBOR.—At Fig Island, Elba Island and the upper flats, an increase of water is reported. To make these improvements fully available, and secure 22 feet of water to the city wharves, it is necessary to carry out the plans laid down by Gen. Gillmore, and to do this $530,000 is needed, and the engineer, Capt. Bailey, reports that the sum can be profitably expended during the year.

THE bids for building the new Court House at Ionia, Mich., range from $42,880 to $66,500.

NEW HOTEL.—Joseph A. McDonald, of Birmingham, Conn., has just completed the drawings of an extensive hotel to be erected under his supervision at St. Augustine, Florida. It is L shaped, each wing being 260 feet long and five stories high, and the main tower being 130 feet high. It will accommodate about 500 guests, and will be finished by Nov. 1, 1884. Its cost will be $150,000. Two million feet of lumber will be used, one-half of which is on the ground now. Mr. Cruft is the owner of two other large hotels, one in Magnolia, Fla., and another in Bethlehem, N. H.

NEW ORLEANS LEVEES.—City Surveyor Brosnan has submitted a report on the city levees. He recommends the capping of the protection levee from the Metairie Ridge toward Eighth street, the amount of which will reach $1,556. Other work, he estimates, will cost $6,300. Along the front of Carrollton a new levee is recommended. Chief Engineer Major Richardson, who accompanied Mr. Brosnan in his inspection tour, concurred with him. This he thinks will cost $28,000. A new levee is recommended to be built from the upper line of the Upper City Park down to Louisiana avenue, and to have it so constructed as to need no revetments, the annual repairs of which are from $12,000 to $20,000.

The cost of the levee would be $31,000. If the present levees from the upper limit to Louisiana avenue are repaired, these needed repairs would amount to about $6,000, which will be brought up to the average annual amount, from $12,000 to $20,000.

A lower protection levee is recommended to be built from the river to the Florida Walk at a cost of $18,975. Three floodgates are required. The cost would be $3,500 each. In the Fifth District the levees require extensive repairs, which would cost $7,647, and along the whole of the rear of the parish a new levee is also recommended. This would cost about $325,250. This suggestion Mr. Brosnan makes to prevent overflow occasioned by the crevasses occurring below and above the city.

DETROIT CITY is now defendant in a case for infringement of patent. The Detroit *Post and Tribune* of Oct. 6 says: "In the United States Circuit Court yesterday the city of Detroit was made defendant in a suit for $50,000 damages brought by James Flower & Brothers, the well-known machinists and manufacturers. The bill of complaint recites that in 1868 Thomas R. Bailey invented and had patented an improvement in fire plugs and hydrants, which he subsequently assigned to the complainants. In February, 1876, the latter discovered that owing to a defect in Bailey's application for a patent the letters-patent granted thereon were also defective. Upon making the discovery the complainants at once took steps to have the error corrected, and a new and perfect instrument was issued. It is alleged that the city began using an infringement of the patent soon after the first patent was granted and has continued to do so ever since. The bill asks for a perpetual injunction against the city and a temporary one restraining the use of the improvements pending the settlement of the case."

THE LOS ANGELES WATER CASE.—The Supreme Court of California reversed the judgment of the lower court in the case of the Anaheim Water Company vs. the Semi-Tropic Water Company. "Plaintiffs assert a right to divert from the river sufficient water to keep their ditch, which is 6 ft. wide at the bottom, 8 ft. wide at the top and 2 ft. deep, flowing full at all times and seasons of the year, and the court below secured them this asserted right without regard to the quantity of water that may be left in the river when such a quantity is so diverted, irrespective of the wants and necessities of the owners of the Santiago de Santa Ana Rancho, under and for whom the defendant asserts the right to divert a portion of the waters of the river." The opinion concludes as follows: "The plaintiffs have acquired no right to any portion of the water that appertains to the owners of the Rancho Santiago de Santa Ana. The decree of the court below cannot be sustained. We must therefore reverse the judgment and remand the cause for a new trial. In doing so we think it not improper to suggest, in view of the value of the water in dispute and the large interests at stake, whether it is not advisable for the parties to the controversy to divide the water upon an equitable basis and devote the money that may otherwise be expended in litigation in the proper development and judicious use of it."

RAILROADS IN CALIFORNIA.—The goal to which the growth of railroad pools shows that the whole country is traveling California has reached. As the federation of States has worked into one union, the "federation of railroads" appears to be groping its way toward one railroad, or what will practically be the same thing—a national union of the three or four sectional pools into which they are gathering themselves. In studying the present of the California railroad system we are looking into our own future. The view uncovers a good deal of the same abuse of power, the same disregard of corporate obligations, and to be fair, the same enormous stimulation of the prosperity of the people that is to be seen in other parts of the world. And, take it for all in all, the net result of a candid observation is not discouraging to those who believe that the stock that would not submit to the tyranny of a mother country will not lie down under the trampling feet of corporations and wealthy men bred by itself. Indubitable evidence may be seen in California that the temper of the community is such that it is only a question of time when the corporations must take up the cross of citizenship and put their necks under the yoke of the law, just like poorer and less powerful people

A LEAK IN THE SEVERN RIVER TUNNEL.—London, Oct. 11.—The outburst of a land spring occurred to-day on the Monmouth side of the tunnel under the River Severn, causing the workmen to flee to the Gloucester side of the stream. The pumps have thus far failed to check the rising of the water.

THE rock work in Mullan tunnel is rapidly drawing toward completion, and trains will be able to pass through before snow covers the summit of the pass. Less than 125 feet of bench work remains to be done, which, being completed, the tunnel will be about ready for the track-laying.

A MORGAN BRANCH.—The contract to build the Morgan branch road from Baldwin Station along Bayou Cypremort will be awarded to Messrs. Rogers & Ballentine. The branch, so the *Racket* reporter is informed, will be fifteen or twenty miles in length and will tap the richest sugar lands in the State. This week Mr. Ballentine will make a reconnoissance of the country preparatory to the regular survey of the line.—*New Orleans Times-Democrat.*

COKE DRIVING OUT ANTHRACITE.—During the present year coke has made startling inroads into the foundry trade of anthracite coal in the Eastern and Middle States, where formerly the best grades of Lehigh lump were used to melt the iron in cupolas for machinery and stove castings. Connelsville, Snow-Shoe, and other cokes are so extensively used that no more than one-quarter or one-fifth of the quantity of anthracite used years ago are consumed. The low price of the coke and the comparatively stiff figures for anthracite have, of course, brought about this revolution. It is likely that the difference between the price of the two grades of fuel will not remain so great for any length of time, but the new rival is undoubtedly in many respects better suited for the purpose, and it will be difficult to dislodge it.—*Mining Journal.*

A CONTRACTOR'S CLAIM.—Albany, Oct. 10.—Architect Leopold Eidletz, of the new Capitol, has had hard luck in collecting his claim for expenses incurred in repairing the ceiling in the Assembly Chamber. The Capitol Commissioners gave him permission to remove the cracked stones last winter at his own expense, it being tacitly understood that he would be reimbursed by the Legislature. Gov. Cleveland vetoed the contractor's claim for $3,159.55 for his purpose in the Supply bill, and to-day the new Board of Claims dismissed his case as not a proper claim against the State.

JAPANESE RAILWAY CONSTRUCTION.—The construction of railways in Japan during the past year has proceeded steadily. From a consular report just issued we note that the number of miles now open between Kôbé and Otsu is fifty-eight. Forty-seven miles of this line, the section between Kôbé and Kiôto, lies through the plains, with good gradients and easy curves. On the other eleven miles between Kiôto and Otsu the gradients are heavy, a great portion of the line being laid out to an inclination of one in ten, which necessitated more powerful engines to do the work. All the engines are obtained from England, a contract for four new ones having been given to a Glasgow firm. The iron rails first laid down are being replaced, as they wear out, by steel, in accordance with the modern practice. The rails and all raw material, wood excepted, come from England. On the other side of Lake Biwa railway work was in progress on the branch from Nagahama to Sekigahara, a distance of 14¾ miles, which was to be opened by the end of April. The works here are light, especially at the Nagahama end, where, for some five miles, the line traverses the plain by the lake side on a small embankment. Further on, at the Sekigahara end, there are some excavations, but nothing remarkable in that way. There is also in hand the line from Nagahama to Tsuruga, which, when completed, will be about 26½ miles long. The tunnel under the Yanagase hill is not yet finished. The total length is about 1,400 yards. The heading had, at the end of March, penetrated 700 yards into the hill. The rock is very hard and has given much trouble, but it is being dealt with now by compressed air drills, in the same way as the St. Gothard and Mont Cenis, and the rate of progress is increased thereby. Except the tunnel the line is done, and passengers are, and have been for some time, taken to the foot of the mountain on each side, when they have to get out and walk over the pass.—*The Architect.*

MILWAUKEE HARBOR IMPROVEMENTS.—Col. D. C. Houston, of the United States Army Engineer Corps, in charge of the river and harbor improvements, reports that the work upon the harbor of refuge in Milwaukee Bay has been suspended for the season of 1883.

SIGNAL SERVICE STATION IN ALASKA.—Lieut. Ray and party arrived at San Francisco Oct, 7. Lieut. Schwatka, whom they took up at St. Michaels, came down with them. Lieut. Schwatka stated that the result of Ray's labors was satisfactory, that his report to the department would make clear the advisability of a signal station at Point Barrow.

THE Winnipeg & Duluth R. R., is to be pushed forward early next season. The route as decided on lies along the south side of Clearwater River, and the main Red Lake River will be crossed about a mile below its junction with the Clearwater.

HELENA, OCT. 5.—At a meeting of the Helena Steam Power and Lighting Company last night it was decided to make an assessment of 20 per cent. on the capital stock of the company, and immediately send Mr. H. M. Ogden, their electrician, to the principal cities of the East for the purpose of examining into the relative merits of the different systems of lighting. Heretofore the work of the company has been largely experimental, though they have been supplying about 50 arc lamps. It is the purpose of the company to erect a building of their own and introduce the most approved machinery and system of lighting. They expect to be able to double their present number of lamps.

AT WORK ON THE CAPE COD CANAL.—SANDWICH, Mass., Oct. 11, 1883.—Three dredges and pile drivers, with a large number of workmen, have arrrived here and work will be at once commenced upon the Cape Cod Ship Canal. Within three weeks 500 men will be laboring upon the line of the canal.

NEW GAS COMPANY.—The Supreme Court of Georgia has granted permission for the new Gas Company, of Atlanta, Ga., to proceed with the construction of its works.

HON. E. G. CRACRAFT, of West Virginia, is booming a new railroad from Charleston, Kanawha County, to Beverly, Randolph County, in that State, to be known as the Kanawha & Western Railroad.

NEW ROADS IN MAINE.—Mr. Merrill, of the firm of Foss & Merrill, civil engineers of Concord, N. H., with three assistants, is engaged in surveying the last proposed route of the projected railroad between Kittery Depot and York Harbor, by way of the Lower Foreside and Kittery Point.

The people of North Anson are agitating the construction of an extension of the Somerset Railroad from that town to New Portland, seven or eight miles. A survey of the route will soon be made.

BUFFALO CITY ENGINEER.—Among the candidates is Mr. Albert Krause, who has been in the Engineer's office during the last sixteen years.

NEW TELEPHONE COMPANY.—The McDonough Telephone Company has been incorporated. The capital is $1,000,000, with the proviso that it may be increased to $20,000,000. The principal office will be in New York. The lines are to extend from New York to San Francisco, New Orleans, etc.

THE BRIDGE at Dell Rapids (Dak.) is completed.

IT is proposed to build an extension of the Pennsylvania from Reading to Pottsville.

THERE is some talk of having a road from New Orleans to Fort Worth (Tex.).

DRAINAGE AT NEW HAVEN (CONN.).—Beaver Ponds are to be drained; a sewer 550 ft. long will be built at a cost of $15,000.

IRON BRIDGE FOR NEW HAVEN.—The sum of $3,200 has been voted for an iron bridge over the channel of Mill River.

DALLAS (TEXAS) WATER SUPPLY.—A Capt. Conner has a surveyor at work to a point three miles from Dallas.

ELECTRIC LIGHT.—Winona, Minn., will be lighted by Vanderpool & Co.'s machinery, for $7,500.

BOSTON ITEMS.—*Salary of Chief Engineer.*—At last meeting of City Council an order to allow the city engineer not exceeding $1,000 for services as engineer at the water-works at Ashland basins and Farm pond was debated at length. It was referred to the committee on salaries. The ground of opsition was that the city engineer was now getting all the money he was entitled to.....*Dorchester Bay Tunnel.*—An order was passed to pay R. A. Malone $28,356.28 additional, in final settlement for work in construction of Dorchester Bay tunnel. Mr. Malone has broken down in health and lost $30,000 by his contract.....*Extension of Streets.*—Sterling street is to be extended from Cabot to Warwick street at a cost of $11,683 and East Ninth street is to be laid out at a cost of $31,450.

GOULD'S RAILROADS.—Gould's Southwestern system, about 9,523 miles, is under a single management, that condition having been brought about by an intricate system of stock ownership, leases and sub-leases. If he adds the Louisville & Nashville's 3,233 miles, the total mileage will be 12,756

The mileage of which Jay Gould is a director is, so far as we are at present aware, as follows: Southwestern system, 9,523; Louisville & Nashville, 3,233; Chicago & Northwestern, 3,552; Chicago, St. Paul, Minneapolis & Omaha (owned by Chicago & Northwestern), 1,239; Chicago, Rock Island & Pacific, 1,744; Union Pacific, 4,413; St. Louis & San Francisco, 724; Atlantic & Pacific, 575; New York & New England, 478; Delaware, Lackawanna & Western, 930; Manhattan Railway (elevated), 32; total, so far as we know, 26,443.

HYDRAULIC CURIOSITY.—Lost River, Idaho, is a hydraulic curiosity. The *Idaho Statesman* says of it: The stream is larger than Wood River, and flows with a good current between firm and solid banks until it reaches the lava plains, where it has heretofore been thought to disappear in the rock. This has, however, been found to be an error, as the course of the stream can be easily traced some twenty miles further, flowing through a cleft in the lava, having changed its course to the northeast, and at last flowing close to the foothills, sinks in an open sagebrush plain. Some twenty-five miles beyond Arco, which is situated in the lower part of the Lost River Valley, is what is known as the Little Lost River. This stream also ends its course by being lost, or sunk in the lower plain.

THE OREGON SHORT LINE COMPANY has given notice of an increase in its capital stock from $4,000,000 to $12,000,000.

SHAWNEETOWN (MO.) is to be protected from high water, and the levee is to be raised two feet above all the waters except 1883; the contract has been awarded to the Ohio & Mississippi Railway Co. The repairing will be about 200,000 yards at 15 cents per yard.

THE FIRST WHITE LABOR ever employed on the South Florida railroads made its début a few days ago. Thirty able-bodied Irishmen were put to work on the International Railroad.

THERE is talk of lighting Port Gibson (Miss.) with the electric light.

CLEVELAND WATER-WORKS.—Superintendent Whitelaw has been instructed to at once advertise for bids for the work on the new high service reservoir to be erected on Kinsman street. The time for the completion of new reservoir is to be December, 1884, at which time the Fairmount street basin will also be finished. Its cost should be about two fifths of that of the Fairmount reservoir, which is to cost $350,000.

R. R. ITEMS.—It is probable that the Denver & New Orleans will soon be extended further south to the junction with the Fort Worth & Denver City. A new rail route between Colorado and the South will thus be formed.

The Canadian Pacific's bridge across the Salmon River above Yale, recently completed, has one span of 200 and two of 83 ft. each. The approaches upon either end are 83 ft. The height is 125 ft.

The Sioux City & Pacific expected to build 150 miles of road per year in the direction of the Black Hills country, going by way of Antelope Creek and the White River.

Steel rails have been purchased for the Fargo & Southern, and are now loading at Pittsburgh on the company's cars. The road will be completed to Ortonville within the time promised.

The engineering corps of the Cannon Valley road is still in the vicinity of Mankato. It is engaged in running lines and making observations, but everything so far is in a chaotic state.

The surveyors of the Spirit Lake & Western Railroad have arrived at Pipestone Minn., having finished the line from Sibley to that place. The party is in charge of Chief Engineer Devine. The road will be built early in the coming spring.

KANSAS CITY (MO.) VIADUCT.—The Council has decided to build a viaduct between the north and south parts of Kansas City. The cost must not exceed $16,000, with a roadway of 18 ft. in the clear.

NEW ORLEANS PAVEMENT.—The Council has accepted the bids of the Barber Asphalt Company to pave St. Charles street. The wearing surface will be composed of: 1. Refined asphaltum; 2. Heavy petroleum oil; 3. Fine sand, containing not more than 1 per centum of hydrosilicate of alumina; 4. Fine powder of carbonate of lime.

Petroleum will be freed from all impurities and brought to a specific gravity of from 18° to 22° Baume, and a fire test of 250° Fahrenheit.

The sand and asphaltic cement are to be heated separately to 300° Fahrenheit.

The pulverized carbonate of lime, while cold, will be mixed with the hot sand in the required proportions, and this mixture mixed with the asphaltic cement at the required temperature, in the proper proportion.

This wearing surface will then be carefully spread on the cushion coat by means of hot iron rakes so as to give a uniform and regular grade and to such depth that, after having received its ultimate compression, it will have a thickness of two and a half inches. The surface will then be compressed by hand rollers after which a small amount of hydraulic cement will be swept over it, and then be thoroughly compressed by a steam roller weighing not less than 250 pounds to the inch run, the roller being continued for not less than 5 hours for every 1000 yards of surface.

INDIANAPOLIS CONTRACTS.—The contract for the improvement of Michigan street was awarded to S. W. & R. H. Patterson at 63½ cents per foot for bowldering and 42 cents for curbing.

F. Gansburg was given the contract for the improvement of South Meridian street, at 64 cents for bowldering and 42 cents for curbing.

The contract for the improvement of Market street was awarded to Hanway & Cooper at $1.04 cents per lineal foot.

John A. Whitsett was awarded the contract for the construction of a brick sewer on Madison avenue at $1.38 per foot for sewer, $30 for manholes and $70 for catch-basins.

The city civil engineer was directed to prepare an estimate for a bridge across Pogue's run at Wilkins street.

THE surveys for the Opossum Fork levee are nearly completed. Arkansas has subscribed $35,000 for its construction. The contract is to be let.

THE Morganza levee having been advancing slowly, Gov. McEnery has taken the matter up. The contractor, Mr. Meyer, complains of the great sickness among his men. He thus compares white and colored labor: "Most planters think I ought to pay a negro the same wages for day labor as I pay a white wheelbarrow man, who does double the work of a negro. I give negroes station work at the same rate as I do white men, I employ negroes who have no cotton in the field and pay them from $1.25 to $1.50 per day, and it is dear labor compared to the white labor, for which I pay $2 per day. I am prepared to have 500 or 1,000 men at work as soon as it is possible to work them."

MR. FLOOD (Bonanza) is to have a new "palace" on Nob Hill, which will be unique. He will import brown stone from New York. The plans are all drawn. The plans of Mr. Fair, who owns the companion lot to that of Mr. Flood, cannot be ascertained, but it looks as though he expected to add to the Nob Hill mansions.

KANSAS CITY CONTRACTS.—The contract for paving Delaware street with cedar blocks, from Second to Ninth streets, was let to Mesars. Jaicks & Thatcher, of Chicago, for $2.95 per square yard.

A BIG TUNNEL.—The Salina Tunnel on the West Pennsylvania division of the Pennsylvania system has the largest section of any tunnel in the world, being 28 feet wide at springing line and 20½ feet above tide at center of tunnel. It is 1,372.2 feet in length, two-thirds of which is on a six-degree curve, the remainder on a tangent. The tunnel headings, driven from each end, met midway on the curved portion, and when the lines were produced through the aperture they struck within half an inch.

THE STEEPEST RAILROAD GRADIENT in the world is said to be that of a line from Montreux to Glino, a distance of 2,000 feet, just finished by Nicholas Riggenbach, the Swiss engineer who constructed the Rigi Railway. On August 13 M. Riggenbach made the descent with a single car without the cable, in order to demonstrate the efficiency of his brakes, and stopped the car three times on the way. He is constructing a similiar line up the Neilgherries for the Madras Government.

THE Detroit, Bay City and Alpena Railroad will be completed from Michigan Central Junction to Tawas in sixty days. A bridge is to be built across the Rifle River.

THE Cincinnati, Green River and Nashville will soon be surveyed. Mr. Huntington must begin work within ninety days.

SURVEYING the route of the Springfield & Southern Railroad between Hillsboro, Ill., and Greenville is now in progress.

LYNN (MASS.) WATER SUPPLY.—The water board has awarded the contract for constructing a tunnel from Saugus River Valley to Birch Pond to Bond & Bryer, of Lynn.

ST. PAUL (MINN.) WATER-WORKS.—*Heavy Contract.*—At the last meeting of the Board of Water Commissioners the president was directed to advertise for water pipe to be used in the supply from Lake Vadnais over Rice street, the bids to be in prior to a meeting to be held just before his departure for Europe Nov. 5. The pipe that will be required is twenty-four and thirty inches in diameter, and will weigh about 5,000 tons. It is estimated that it will cost not less than $200,000. It must be delivered by April 1.

WORK ON THE PANAMA CANAL.—The Philadelphia *Press* reports an interview with Engineer Gowdye of the Panama Canal Company, who recently arrived from San Francisco to superintend the placing of machinery in the hull of another dredge now lying at Morris' wharf. He says work was being vigorously prosecuted in a hundred different sections of the canal by six thousand

laborers, chiefly West Indian negroes. Six dredges are hard at work loading cars, which dump the earth twelve miles distant. American and English capitalists are supplying the sinews of war for the canal. Besides the machinery built in San Francisco, firms in different parts of the United States supply the company with locomotives, machinery and other materials. In short, America has gigantic interests in the canal, and will continue to have them until it is completed, some seven years hence. Colossal steam shovels are being manufactured at Schenectady and other places in New York, capable of filling an entire truck at one throw. Slaven Bros. will have soon another hull ready to launch and to receive dredging machinery at Morris' yard.

APPLETON (WIS.) WATER-WORKS.—The city of Appleton, Wis., has refused to accept the new water works because they do not fulfil the contract.

CLEVELAND, Ohio, Oct. 9.—The scheme of reorganizing Brown, Bonnell & Co., the iron works company of Youngstown, has failed, and an effort is being made to form a new company, with a capital stock of $1,200,000, and to assume all the assets and liabilities of the old company.

IMPORTANT WATER-WORKS extensions are to be made by the City Council of Springfield, O.

BRISTOL TOWN, Ill., will build a $10,000 bridge.

CONTRACTORS' DIFFICULTIES.—In Philadelphia three persons, Mooney, Noonan and Maier, who had jointly street cleaning contracts, have fallen out about profits and gone to law.

THE NORTH SHORE & SOUTH WESTERN.—An engineer corps, under W. T. Tronah, has left Duluth for Pigeon River to survey the proposed north shore line of the above road. The scheme is backed by English capitalists. The promoters say the work of construction will begin soon after the holidays.

THE VICKSBURG WATER-WORKS.—Most of the property has been purchased. The engineer who built the works at Athens, Ga., for the North American Improvement and Construction Company will have charge.

BALTIMORE HARBOR.—The Harbor Board met on the 5th. The engineer's report showed that 56,000 yards of soil had been removed from the lower harbor, making 144,000 yards in all, about 700 yards from the Middle Branch, a total of 57,600 yards removed from this branch, and a channel from Locust Point to Fort McHenry deepened. It was also reported at the meeting that Col. Craighill had completed the channel to the bay, a distance of about eighteen miles, 27 ft. deep and 250 ft. wide.

CONTRACTS WERE AWARDED on the 5th at the Treasury Department, Washington, to the following bidders for furnishing material for the construction of the first story of the public building at Baltimore: George W. Robinson & Son, bricks, at $8 per 1,000; F. Ellenbock, lime, at 59 cents per barrel; S. M. Hamilton & Co., cement, at $1.04 per barrel, and Edward Heffner, Jr., for sand, at 83 cents per cubic yard. All of the successful bidders are from Baltimore.

CARPENTERS are receiving $5 per day in Sioux Falls, Dak.

NEW ORLEANS WATER SUPPLY.—The water famine still continues, and the outlook for the St. Tammany Water Works Company seems to be better. This latter company proposes to bring water from the Bogue Falaya River.

NEW ALBANY (IND.) BRIDGE.—Col. Bennett H. Young, president of the Louisville, New Albany & Chicago road, has returned to Indianapolis from New York. While absent he revived the scheme of bridging the Ohio River at Albany. In order to carry out arrangements it became necessary for him to resign the presidency of the bridge company.

COURT-HOUSE, ETC., AT COLUMBUS, O.—The following is an abstract of proposals for labor and material for the court-house, etc., at Columbus, O., opened Oct. 9, 1883. The award has not been made:

W. Fish & Sons, $13,000, Amherst, and $12,775, limestone.

Reas Evans, $10,585.20.

A. Dale, Jr., $11,599, granite; $18,330, Dayton limestone.

Jas. West Water, $15,584.

Miles, Garner & Horn, $14,310.

Jacob Viehmeyer, $10,799, limestone, and $13,699, granite.

ASPHALT FLOORING AT PHILADELPHIA.—The contract for asphalt flooring for the court-house, etc., at Philadelphia, has been awarded to the Vulcanite Paving Company.

SURVEYORS IN MEXICO.—It is evident that Mexicans regard surveyors with something of the feelings that Sam Weller entertained for Mr. Pickwick's note book on first making the acquaintance of that gentleman. The following is from a Mexican paper: "Much alarm has been caused in the State of Durango by the operations of surveyors connected with the Zacatecas company, which obtained a grant to determine the boundaries of the public lands with a view to colonizing them. Some large land owners do not like to see surveyors near their properties because they do not know precisely the limits of their vast estates, and are unwilling to subject their titles to scrutiny."

SALE OF NEW MEXICO MINES.—A group of mines near Socorro were sold on Monday to Governor St. Johns.

THE Nicholson pavement in San Francisco is very unsatisfactory, as it swells up after rains into hummocks.

THE Western Illinois Construction Company has been organized at Carrollton. The company will begin to build at once the Litchfield, Carrollton & Western extension.

WACO (TEX.) WATER SUPPLY.—The water furnished in Waco is so bad that the City Council is to consider the construction, by parties now building in Austin, of a new system.

THE Cape Cod Canal Co. has contracted with Fred. A. Lockwood, of Boston, to cut the Canal. Work will be begun immediately.

THE ARKANSAS WESTERN.—Chief Engineer French has finished a four-weeks' survey for the Northern Division of the line. It is 82¼ miles in length. He will now survey the Southern Division to McNeel on the Paramore road.

NEW LINE FOR GONZALES (TEX.).—The party of surveyors who left in August to survey between Gonzales and Cuero, lately returned to former place.

THE MARKET STREET BRIDGE (PHILADELPHIA).—A regular lesson in engineering on the blackboard was lately given the Council Committee by Chiefs Smedley, Ludlow and Estabrook. One estimate is $300,000, the iron bridge; the other, $1,200,000. The durability of certain foreign iron bridges was next cited in support of the resolution. One across the Seine had stood since 1804. The English Swan was crossed at Coldbrookdale by one erected in 1777. As for the matter of width, Blackfriar's bridge, which took twice the traffic off the foot of Ludgate Hill that would cross the Schuylkill at Market street, was 75 feet clear in width. The proposed bridge in Philadelphia was 76 feet. During Chief Engineer Smedley's examination it was developed that the $330,000 iron bridge would stand no heavier flooring than one of wood, and that the footways would have to project beyond the piers. Mr. Smedley's estimate of the life of the structure was thirty years. To build an iron bridge would cost $750,000. After Colonel Ludlow had given his opinion generally in support of Mr. Cummings, and Chief Estabrook was heard from, Mr. Rowan arose, and said it was nonsensical to talk of the stone bridge costing a million and a half and taking three years to build, when a New York corporation stood ready to give security to build it in ten months for less than a million.

LOUISVILLE & NASHVILLE ROAD, ITS EXTENSION, ETC.—The Louisville & Nashville Company has advanced to the Henderson Bridge Company during the year $86,723.71, making the total amount advanced to June 30, 1883, $146,885, all of which has been expended on account of the bridge and its approaches. The Owensboro & Nashville Railway was originally thirty-six miles in length. Arrangements have been made to extend it during the autumn of the present year to Adairville, a distance of eighty-five miles from Owensboro.

THE HOLYOKE (MASS.) RESERVOIR.—The Water Commissioners have begun work on the new reservoir, which, it is expected, will hold 75,000,000 gallons of water. It will cover a space of about 20 acres, and will require the building of two stone and earth dams, each about 175 feet long, one being 20 feet high and the other 15. The entire cost of the reservoir will be about $8,000.

THE Chicago, Burlington & Quincy is to be extended through Carroll County, Mo., some 20 miles. A local paper says: "Mr. Charles S. Beadle informed us that he was in charge of a surveying corps, and that he had started his survey at R. and L. Junction and was running a preliminary survey from that point in a northeast direction. Where his destination was he would not say, probably Rogards Mound. We could not find out by whom he and his men were employed.

THE IRON, METAL AND COAL MARKETS.

PHILADELPHIA, OCT. 12.

The past week has been an unusually quiet one in the iron trade. The reduction in pig iron, inaugurated by the Thomas Company, has not had the good effect that was anticipated. Buyers still think that lowest prices have not been reached, and refuse to place orders for more than current requirements. No. 1 Pig Iron is quoted at $21@$21.50, and No. 2 $19@$20. Gray Forge, $17@$18.50. Bessemer is quoted at $21@$22. Buyers manifest complete indifference, and the market is very weak. Manufactured iron is dull and weak prices fluctuating and the tendency downward. Refined iron sells at 2@2.20c. Large lots average 2.10c., the ordinary run of orders are taken at 2.15c., and retail lots command 2.20c. in some cases. Common iron, 1.80@2c. Western iron continues to come in, and is sold at 2c. and there are rumors of offers at less.

No large transactions can be reported in steel rails, as buyers of large lots refuse to place orders at more than $36.50, and makers are firm at $37 as their lowest price. Retail lots continue to move at $37@$38. Negotiations for 5,000 and 10,000-ton lots are still pending, without any prospect of immediate business.

Plate, tank and structural iron are active in small lots. Mills are full of orders, and makers are in good spirits, though no large orders have been booked for several days past; enough business is in sight, however, to keep mills busy for some time to come. Quotations, 2.30@2.40c. for Tank; 3.50c. for Beams and Channels; 3@3.25c. for Bell. Sheet iron is in active demand for both light and heavy at slight concessions from card rates. Galvanized is in fair request at 40@50 per cent. off, according to quality. Muck bars are in good demand, and the better makes are held at $34@$34.50, while inferior brands sell at $33. Nails are active at $2.90@$3 in car-load lots. Old T rails are offered at $23.25, and double-heads at $26.

PITTSBURGH.

The Western Pennsylvania iron trade has not improved in any respect during the past week. Local furnaces are selling their current production, but outside furnaces are unable to compete with them. Sales are reported of 250 tons Gray Forge at $18, time; 250 tons Bessemer pig, $20.50 cash. Foundry $21 to $22 for No. 1, $19 to $20 for No. 2. Bessemer $21 to $21.50 all time. Muck bars from $33 to 33.50. Nails are active, and prices are firmer, in view of the suspension announced for next month. Quotations, $2.80 to $2.90. Merchant iron is fairly active, but prices are irregular and unsatisfactory. Mills are all at work, but have orders for only a short time ahead. Quotations, 1.85 to 2c. There is a fair movement in wrought-iron pipes at 75 off. Steel rails, $38 to $39 at mill. Old material scarce, but under active inquiry at $23.20 to $24 quoted for ties.

CHICAGO.

The Chicago iron market shows fair activity, though business is of a retail character. The situation in bar iron is unchanged. Small orders are coming in freely and prices are shady at $2.05 to $2.10. Structural iron is in moderate demand; prices are well sustained at $2.75 to $2.80 for tank, $2.90 to $3 for angles, $3.60 for beams; channels $3.80, with occasional shadings for large orders. Shell, 3¾; flange, 4¼. Galvanized iron is active, but prices are weak, and refined is being sold at 45 and 10 off. Black sheets are in large supply and active demand. Norway and Swedish irons quiet and dull. Russian is practically out of the market. Nails are quoted at $3, with only moderate sales. Tubes and pipes are improving; prices are stiffer, and sales are made at 70 and 10 on small, and 75 per cent. on large pipe. The demand is good. Pig tin and antimony are dull. Stamped tinware is in active demand, but there is no advance in prices. Prices of steel are shady, and a moderate amount is moving in small orders. Steel rails are $40 for best quality. There is but little doing except in small orders. The placing of heavy orders will probably begin by Nov. 1.

The pig-iron market is strong and improving. Southern irons are gaining in favor, especially for agricultural purposes.

COAL—PHILADELPHIA.

The anthracite coal trade is in splendid condition. The output equals 750,000 tons per week, all of which is promptly marketed at full circular rates. The advance of 25c. per ton made Oct. 1 is easily maintained, and a further advance is even talked of, but is not at all probable. The mines are all being worked to fullest capacity and the output sold ahead, at least 30 days, but, for some unexplained reason the managers have decided to suspend operations for the first, second, and third days of November. Some very heavy orders have been placed by Northwestern railway companies, and the demand from the West continues very heavy. Last week the Reading made its heaviest westward weekly shipment. Demand from New England and the South is still very active, and the shipments are large and frequent. The Reading company shipped, for last week reported, 308,000 tons, and for year, 8,739,315 tons. Total amount of anthracite sent to market for last week reported, 752,158 tons, and for year, 22,737,530 tons, an increase of 2,084,027 tons. Stocks at shipping ports are nominal.

The bituminous trade is very dull. The capacity is excessive, and competition has reduced prices to very low limits. Production sent to Eastern markets for week ending Sept 29 112,351 tons. For year, 3,652,237 tons.

The coke trade is improving, under a heavy demand from large manufacturing establishments, which have recently started up, and placed large contracts. Prices, $1 to $1.10 at ovens.